A QUARTERLY JOURNAL OF METHODS AND INFORMATION FOR TEACHERS OF SCIENCE

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The SCIENCE COUNSELOR

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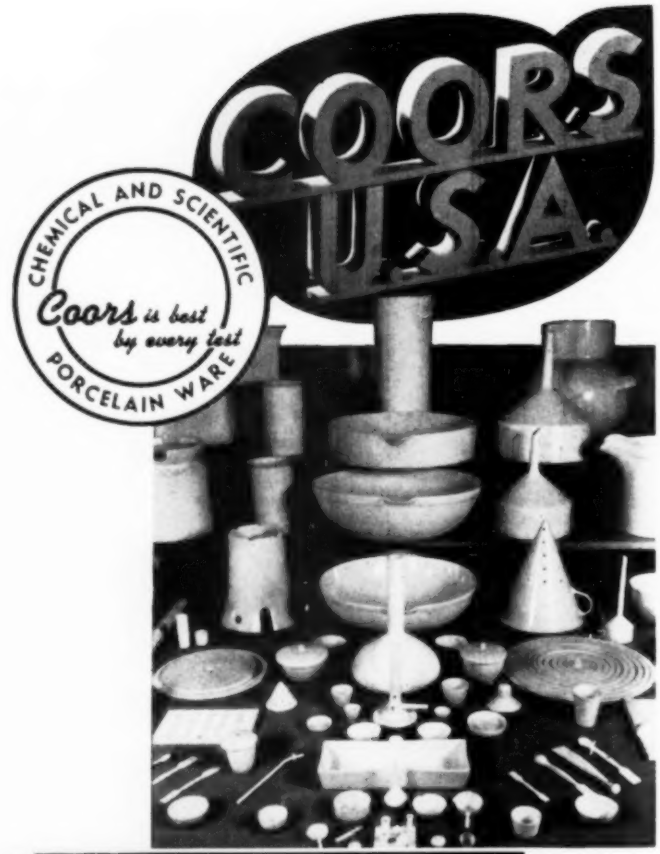
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The Science Counselor

"FOR BETTER SCIENCE TEACHING"

A QUARTERLY JOURNAL *of teaching methods and scientific information especially for teachers of science in Catholic schools. Published at Duquesne University, Pittsburgh, Pennsylvania, in March, June, September and December by*

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Be a Joiner!

No one person working alone can effect major changes in education even in a restricted field. But many persons working under competent direction, faithfully following a common plan toward a desired end, can accomplish much. Applied practically, this means that any significant advances in science education must come through group action.

Teachers of science are not noted as "joiners." They should be. There is much still to be accomplished for science in the schools. There is much that will be lost—is now endangered—because too many science instructors work complacently at their own daily tasks giving no thought to the trends in their profession, trends which they might influence were they not self-centered.

Educators in the science field should consider it a duty to belong to those associations that work for the improvement of science teaching and science teachers. They should join the professional societies devoted to the individual sciences as well as the associations which consider all the sciences, and the other great groups which further the cause of education in general. Membership in national, regional, state, and local associations is desirable. The small local association helps the teacher with his immediate problems; the great national association helps the teacher by advancing the profession as a whole.

But teachers should not join an association merely to receive. Associations are partnerships. Members should contribute to the group as much as they get from it. The annual fee will help solve the association's problems of finance, but it is the members' attendance at meetings, their work on committees, their willingness to experiment and to speak and to write, their friendship and loyalty and enthusiasm, even courage, perhaps —it is these that make an association virile and effective.

The great *National Science Teachers Association*, an affiliate of the A.A.A.S., and a department of the N.E.A., has an ambitious program. Its large and growing membership, its vigorous policies and spirited direction insure worth while accomplishments. The too small fee of one dollar a year includes a copy of the yearbook and a subscription to the quarterly journal *The Science Teacher*. The address is 1201 Sixteenth Street, N.W., Washington 6, D.C.

VERBUM SAP.

The Improvement of Science Teaching

• **By Lloyd W. Taylor, Ph.D.** *(University of Chicago)*
HEAD, DEPARTMENT OF PHYSICS, OBERLIN COLLEGE, OBERLIN, OHIO

This article challenges science teachers to think realistically about their work.

Who or what is to blame for the inadequacies of instruction in the high school science field?

Is the teacher properly trained in both science and education? Does the teaching job lack dignity? Do university science departments have a negativistic attitude toward departments of education?

Did your experience in college teach you that "Many excellent teachers of science at the college and university level are not qualified, unaided, to train prospective high school teachers in the art of teaching"?

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The American Association for the Advancement of Science has a committee whose work is not known as widely as it should be. It is called the Cooperative Committee on Science Teaching. Its membership includes leaders in secondary school education, representatives of the principal sciences at the college level, and educational directors from the industries. The chairman of the committee is Professor K. Lark-Horovitz of Purdue University.

One of the objectives of the committee is to provide a two-way channel of communication between teachers of science at the college and university level on one hand, and those at the secondary and primary school levels on the other. In the interest of both the colleges and the public schools, to say nothing of the even greater interest of the general public, the present utterly inadequate channels of communication between the different branches of our educational system must be broadened and deepened, and a life-giving stream of educational interchange be made to flow through them.

In the United States, as in no other country, there has developed an ideal of education for all. Our salvation may lie in this vast reservoir of confidence and good will toward the educational enterprise. The great war just ended placed a huge new premium on this ideal of education for all. Unfortunately the same war all but stripped us of our supply of teachers, not only during the war, but for at least a decade to come.

The case is well stated in the latest report of the committee, which appeared in *School Science and Mathematics* for February, 1946.

"The end of World War II has confronted American education with two highly disturbing facts. The first fact is that the survival of modern civilization depends upon the understanding and control of scientific techniques whose power for good and evil dazes the human imagination. The second fact is that our teachers and our equipment for teaching this understanding and control are woefully inadequate.

"Science teaching, particularly at the High School level where the ordinary citizen finishes his formal education, is not ready in America for the responsibility which it must nevertheless assume. Nor is education ready in other subject areas for its obligation in an atomic age. The time is short. The task is nothing less than to lift a whole generation of American citizens to a level of knowledge and human goodness which has hitherto been attained by only a small fraction of our people."

The magnitude of this objective, coupled as it is with the virtual certainty of catastrophe if it is not attained, is positively frightening. And it is not made any less so by the question which immediately occurs: "Why limit this program to 'a whole generation of *American* citizens'?" Indeed if we do so limit it, shall we not jeopardize the whole undertaking? If two world wars in one generation have taught us anything, it is that one powerful nation, if unscrupulous, antisocial, and willing to engage in international brigandage, can frustrate the peaceful intentions of all the rest of the world. The ideal then, however unattainable it may just now seem to be, is to include all the major powers in such an educational program.

It is hard to be optimistic about the realization of such an ideal. But all such global ventures must be approached by stages. And the first stage of this one is to discover and correct our own shortcomings. The report referred to above describes them in this way:

"Blame for the inadequacies in the teaching of High School Science and mathematics belongs with the American public, which has failed to pay its teachers decently, and with the American college and university which have failed to prepare prospective teachers for the kind of teaching they should do. There are three primary and interrelated problems:

"1. Too few really able men and women are being attracted to science teaching in public schools because salaries are indecently low and the job lacks dignity.

"2. The typical science teacher is not being properly trained for the actual teaching assignment he must accept, especially at the beginning of his career.

"3. The High School science curriculum needs a thorough reorganization and the material equipment for science teaching in all but the largest schools needs modernizing."

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The Chemist in Court

• **By Albert P. Sy, Ph.D.** *(University of Buffalo)*
PROFESSOR OF CHEMISTRY, UNIVERSITY OF BUFFALO, BUFFALO, N. Y.

You will not stop reading this unusual article until you finish it.

Here a famous forensic chemist takes you backstage in the courtroom as he describes some of the dramatic legal scenes in which he has participated. Incidentally, he teaches you some good chemistry.

How well do you really know chemistry anyway? Well enough to risk a life on your knowledge?

A Typographical Error and Perjury

One of the prescribed subjects for majors in chemistry at the University of Illinois fifty years ago was toxicology. I studied it.

Shortly after coming to the University of Buffalo I had a minor part in a famous case of homicidal poisoning. Mr. B. was accused of having given his wife hydrocyanic acid with her medicine. Both defense and prosecution used a formidable array of attorneys and experts. I was behind the scene looking up references and making chemical and physiological experiments for the two defense experts. The chief expert for the prosecution was Dr. V., a former professor of chemistry. He had had no practical training of any kind in toxicology, and this was his first experience in forensic chemistry.

The autopsy material had been sent to Dr. V. by the district attorney. Since hydrocyanic acid was suspected, Dr. V. proceeded to find it. He tested filtrates and distillates with ferric chloride and yellow ammonium sulfide (sulfocyanate test), getting a pale reddish color; with silver nitrate, getting a precipitate which, he testified, "seemed to be silver cyanide"; with ferrous sulfate and hydrochloric acid, getting a "greenish precipitate, or Prussian blue". Up to now he had made some rather extravagant claims for the results of his "tests". As a climax he made, and later in court described, the nitroprusside test. He testified that he had obtained filtrates from each of the viscera and had tested each with a mixture of potassium nitrate, sulfuric acid, and ferric chloride; after heating this mixture, ammonium hydroxide was added and filtered. On adding yellow ammonium sulfide a violet color was produced which Dr. V. said indicated that the viscera contained hydrocyanic acid.

I was familiar with this nitroprusside test and knew that Vortmann, the originator of the test, had used potassium nitrite, not nitrate, to form the necessary nitrous acid; and that he used colorless ammonium sulfide, not the yellow variety. I repeated the test several times with nitrate, but got only negative results. Dr. V. had testified that he had made the test as outlined in Witthaus and Becker: *Medical Jurisprudence, Forensic Medicine and Toxicology.* Consulting this text, I found that the directions did call for nitrate instead of nitrite. This was obviously a typographical error.

On the following day Dr. V. was recalled, and asked if he followed directions for the test exactly as given in W. and B.'s text. He insisted repeatedly that he did. Dr. Witthaus, who had been summoned from New York, then took the stand and testified that "nitrate" instead of "nitrite" was a printer's error, and that the test could not be made with nitrate.

In his charge to the jury, the judge asked them to ignore all testimony of Dr. V. In spite of all this confusion, and probably because of the defendant's reputation in the community, he was found guilty. On appeal the verdict was reversed, and the defendant acquitted.

A Simple Arsenic Test

Dr. B. was a well known pathologist in a large hospital. He made an autopsy, the results of which indicated poisoning by arsenic. Since the chemical identification of arsenic is simple, requiring little apparatus and only a few common chemicals, Dr. B. decided that he would make the test himself instead of bringing another expert into the case. His test was positive for quite appreciable amounts in various parts of the body, and he so testified in court. Since there seemed to be no reason for suicide, and the symptoms for arsenic poisoning were not pronounced, the insurance company asked me to verify Dr. B.'s findings.

We were both on the same side of the case and Dr. B. told me in detail just how he had made the test. Everything was quite proper until I asked him if he had made a blank test with the chemicals he had used. No,—he thought that was unnecessary since all the chemicals he had used were labeled "arsenic free".

You will know what happened. When I made a blank test with his chemicals, the result was positive for arsenic. Using my own chemicals which were labeled and tested by me as "arsenic free", all tests with the autopsy materials were negative. In court the next day Dr. B. bravely admitted his error, as every true expert would, and accidental or deliberate criminal poisoning was ruled out.

The Accommodating Coroner's Physician

Dr. H., a prosperous business man, had recently taken out considerable life insurance with a two-year suicide clause. A few months later as he was preparing for a vacation he died very suddenly while shaving. An autopsy was made by the coroner who testified at the inquest that after cutting open the stomach there was a very strong odor of ammonia, "enough to knock you over." A search of the medicine cabinet revealed an empty bottle labeled "Aromatic Spirit of Ammonia".

The coroner's jury found that H. had died from poisoning by aromatic spirit of ammonia taken by mistake, and permission was given for burial. The insurance company refused to pay the claim. I had told them that aromatic spirit of ammonia does not cause such sudden death as in this case. It also developed that Mr. H. was financially embarrassed, and there were reasons to suspect suicide.

The dead man's family refused a second autopsy; however, the insurance company obtained permission from a supreme court justice to disinter and make a second autopsy. At this autopsy it was discovered that the stomach had never been opened. Testimony after the first autopsy that there had been a strong odor of ammonia was purely imaginary, and probably suggested by the empty spirit of ammonia bottle. It was also perjury.

When the stomach was actually opened at the second autopsy there was a strong odor of hydrocyanic acid, and a hanging drop of silver nitrate became turbid (white) immediately. In the stomach contents I found considerable amounts of potassium cyanide. The insurance was not paid, the case being considered suicide.

Loaded Blank Cartridges

During the firing of "blank" cartridges in a stage performance a spectator in the balcony was hit in the eye, necessitating its removal. On dissecting the eye the surgeon found a piece of foreign matter about one millimeter in diameter. It was supposed to be either a piece of smokeless powder, a small birdshot, or a piece of a defective shell. This would place the responsibility for the accident on the powder manufacturer, the dealer in blank cartridges, the maker of the shell, or, perhaps, the producer of the play.

The accident insurance companies pooled their interests and asked me to examine the object which had caused the accident. The attorney for the claimant refused to let me examine the object, saying that there was not enough material for making tests. A court order compelled him to let me see it. He finally allowed me to cut off a particle just barely visible to the naked eye, saying he believed no analysis could be made of so small a piece. Simple microchemical tests proved it to be lead. The insurance companies promptly paid the claimant for his lost eye.

A New Explosive

A man who walked to work was in the habit of taking a short cut through a vacant lot. One morning he noticed a neatly wrapped package, which exploded when he picked it up. It killed him. Detectives discovered that a Mr. R. was a boarder in the killed man's home, and also interested in the landlady. He was arrested on suspicion.

Remnants of the bomb and contents were delivered by the prosecutor to a self-made "expert" who admitted he was an expert in everything that could be called forensic chemistry,—physics, microscopy, handwriting, and many other fields. On several occasions he had been suspected and accused of resorting to tricky testimony based on tricky experiments, and sometimes on imaginary results of experiments he did not make at all.

On a piece of paper found in the defendant's room were written the words "potass. chlorat." Defendant testified that he had used the chlorate for a throat gargle, a common practice years ago. This gave the "expert" an opportunity to reconstruct the bomb. To supply a detonator he proceeded to find traces of nitric acid. Then in his imagination—and testimony—this is what happened: a test tube containing nitric acid was placed upright in about a pound of potassium chlorate in a paper bag, and carefully wrapped. When the package was picked up the acid spilled into the chlorate, exploding the mixture. He offered to prove his theory by constructing a small bomb in the courtroom.

Looking directly at me, the presiding judge said that the experiment might not be appropriate in a crowded room. I assured him that there was not the slightest danger, since nitric acid and potassium chlorate do not constitute an explosive mixture.

With the judge's permission, the "expert" placed about an ounce of chlorate on a board and poured concentrated nitric acid on it. Of course there was no explosion, not a sign of any chemical reaction. He then claimed that the chlorate was probably not finely enough pulverized.

Taking another sample he proceeded to rub it with a large spatula in such a way as to incorporate a considerable amount of wood fiber with the chlorate. I'll give him credit for probably knowing that chlorate and organic matter might constitute an explosive mixture. I explained to the judge what was going on, that the expert was introducing something not mentioned in the testimony.

The defense attorney promptly moved that all testimony of the "expert" be stricken from the record. It was. But the defendant was found guilty because of circumstantial testimony. Later the supreme court reversed the lower court, and the defendant was released.

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The Concentrated-Arc Lamp . . .
A Pin-Point Zirconium Lamp of Many Uses

• **By W. D. Buckingham, B.E.E.** *(Case School of Applied Science)*
ASSISTANT TO ELECTRONICS RESEARCH ENGINEER, THE WESTERN UNION TELEGRAPH COMPANY, NEW YORK, N. Y.

A wartime secret can now be told!

Here is an exciting story of a new kind of lamp which does "impossible" things.

Its dazzling white light comes from a microscopically small luminous spot which, per square inch, is one-sixteenth as bright as the sun. A beam of this light will carry your voice to a friend several miles away and do it secretly. The new lamps have classroom and laboratory applications.

Don't miss this article.

●

The Concentrated-Arc is a new type of electric lamp which produces its light from a pool of white hot molten zirconium. This pool may be smaller than the point of a pin and ten times as bright as the incandescent wire in the ordinary household type of tungsten filament lamp. The extreme brightness and smallness of the new lamp make it possible to do many things which would otherwise be impossible, and its use is resulting in major improvements in the fields of lighting, photography, microscopy and projection. In addition, the intensity of the light may be made to vary in accordance with the vibrations of speech, music or telegraphic code, so the new lamp can be used to carry signals, voice, or music over a narrow beam of light, just as they can be sent over a wire.

The lamp was invented just prior to the war in the Electronics Research Laboratories of the Western Union Telegraph Company, which are situated on the eastern end of Long Island, near Southampton. During the war the lamps were classified as secret, and research was continued under a contract issued through the Optics Division of the National Defense Research Committee. Several interesting war applications were found for the lamps but these war uses are still secret.

The new lamp is an arc lamp, but differs from the usual carbon arc in that it has permanent, fixed electrodes which last for hundreds of hours. They are sealed into a glass bulb filled with an inert gas, usually argon. The name "concentrated-arc" comes from a characteristic of the lamp which makes it possible to concentrate the arc activity upon an extremely small area of the electrode so as to produce a dazzling white light from a source in the form of a tiny luminous circular spot, which is fixed in position, sharply defined, and uniformly brilliant. The spot forms on the end of the negative electrode and its diameter, in a two-watt lamp, is only 0.003 of an inch, which is just about the thickness of a human hair. The maximum brightness of this tiny source is 65,000 candles per square inch, which is 20,000 times as bright as the flame of an ordinary candle and one-sixteenth as bright as the sun.

When it is said that the brightness is 65,000 candles per square inch, it means that a source of the same brightness and one square inch in area would produce 65,000 candlepower. The area of the 0.003 inch diameter disc of the two-watt lamp is only 0.000009 of a square inch, so the actual candlepower of this lamp is a little less than one candlepower. Thus a two-watt Concentrated-Arc Lamp gives a little less total light than a single candle but produces it from a tiny source 20,000 times brighter than a candle and having an area no greater than that of the end of a hair. The lamps have been made in larger sizes ranging up to a 1500-watt

A MODEL OF THE NEW CONCENTRATED-ARC LAMP which is available commercially in sizes from 2 to 100 watts. A 10-watt lamp is shown.

lamp which has a luminous spot three-eighths of an inch in diameter.

The negative electrode is the unique element of the new lamp. It consists of a tube made of a very high melting point metal such as tungsten, molybdenum, or tantalum which is packed with powdered zirconium oxide. During manufacture, the exposed oxide surface at the end of the tube is converted to metallic zirconium. When the lamp is operating, this extremely thin layer of zirconium metal is melted and maintained at a temperature of more than 4500°F. by the heat of the arc. It is this thin film or pool of incandescent molten zirconium which is the chief source of the light from the lamp. The molten film is so thin that surface tension holds it to the oxide backing so the lamps can be burned in any position.

Some of the light of the new lamp comes from a cloud of exceedingly hot argon gas and zirconium vapor which extends for a few thousandths of an inch from the surface of the incandescent pool. Most of this zirconium vapor becomes ionized and is drawn back to the pool. Any loss is replaced from the underlying zirconium oxide. Because of these processes, the lamps last for hundreds of hours as compared with an ordinary carbon arc lamp whose carbons must be renewed after only a few minutes of operation.

In the past, light has been obtained from flames as in candles, from hot solids as in the ordinary tungsten-filament lamp, from fluorescence as in the new fluorescent lamps, and from gas discharges as in the familiar red neon lamps so widely used for advertising purposes. Western Union's new lamp differs from all of these because its light comes from a luminously hot pool of molten zirconium.

Zirconium is a silvery white metal which melts at a temperature in excess of 3800°F. It occurs in nature as the silicate and as the oxide. Natural zirconium silicate, or zircon, is a semi-precious stone which is sometimes used as a substitute for diamond. The zirconium content of the earth's crust is estimated to be about 0.028 per cent.

The uses of the new lamp are based upon its three unique characteristics, which are the microscopically small size of the source, its extreme brightness, and its excellent modulation properties. Since the light rays radiate from what is almost a single point, the lamps are finding wide use as point sources. Of course, there is no such thing as a true point source, for if the source is a point it has no area, and having no area would have to be infinitely bright to be visible.

Point sources can be used to throw very sharp shadows. If a Concentrated-Arc Lamp were to be used to project the shadow of the clutching hand in a movie thriller, every detail, including each silhouetted hair on the monster's hand and arm would appear in the shadow. Along more practical lines, the pin-point lamps can be used as lensless projectors of diagrams and maps to produce oblique and distorted enlargements far beyond the capacity of ordinary equipment, for there is infinite depth of focus. A transparency of an ordinary map can be very easily projected so that it appears as it would to a person viewing that portion of the earth from any altitude and from any point of the compass. Such maps have appeared in popular magazines to illustrate geographical relationships but they have been laborously calculated and hand drawn. The ease of making such projections with the new lamp makes it a valuable aid in map making and the teaching of geography.

The point source lamps are finding application in many different fields. They are used in optical designing, testing and demonstrating. Physics teachers find them excellent in showing refraction and diffraction phenomena, and laboratories are using them for photographing shock waves set up by objects traveling through the air at supersonic speeds. Doctors use them for eye testing, and artists for high-lighting sculpture.

The high brightness of the new lamps makes them excel in the fields of projection and spotlighting. For example, in a recent test it was found that the 500-watt tungsten projection lamp in an 8-millimeter motion picture projector could be replaced by a 100-watt Concentrated-Arc Lamp and a slight gain in screen brightness obtained. In another instance a doctor wished to make motion pictures of the growth of laboratory samples of cancer cells over long periods of time but was unable to do so because of the lack of a suitably bright long-lived lamp. A Concentrated-Arc Lamp solved his problem.

When these high-intensity, pin-point lamps are used with optical devices such as condenser-type photographic enlargers and microscopes, the tiny source acts as the diaphragm or "stop" of the system so that images are produced which are unusually sharp and have great depth of focus. That is, the enlarger produces pictures of a quality such as would be obtained if the enlarger lens were stopped down to *f*200 or less, but without the loss of light that would ordinarily result from such a procedure. Astonishing detail can be obtained from good photographic negatives with a gain in contrast, because of the reduction of scattered light, and a sharpness which gives the pictures the quality of an etching. The depth of focus is so great that oblique enlargements can be made. This has great practical significance as illustrated by the photographer who said, "This is wonderful! By using this lamp in my enlarger I can make pictures in which fat ladies will look thin".

Scientists find that their microscopes have higher resolving power and give clearer, more detailed views when their specimens are illuminated with the new lamps. All levels of a reasonably thick object can be brought into focus at once, not just the high parts or the low parts as is now the case.

The Concentrated-Arc Lamp is not the first lamp which could be modulated, but it is by far the smallest and the brightest, and its modulation characteristics are as good as if not superior to those of any other lamp. This means that its light output will change exactly in accordance with the changes in the lamp current even when such variations occur at very high

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A Physics Course for Every Student

• **By W. B. Herron**
HEAD, DEPARTMENT OF PHYSICS, BUTLER PUBLIC HIGH SCHOOLS, BUTLER, PA.

Have fifty per cent or more of your high school graduates studied physics, or is it ten per cent or less?

Is physics too difficult for the average student? If so, what should be done about it? Shall we teach non-mathematical physics to more students, or highly technical physics to few?

These are some of the questions Mr. Herron and his staff asked themselves. Here are their answers.

Should every high school student have a course in physics?

For every physics teacher who would answer yes, probably twenty would answer no. "Physics is too difficult, it is not possible for the average student to master the course."

I would like to challenge this attitude on the part of teachers by telling what we have done in Butler High School.

Our school is typical of a great many schools throughout the country. We have about 1900 students in the upper three grades. We graduate about 500 students each year, and about 275 or a little over half of these have had a course in physics. Many equally large schools will be satisfied with 50 graduates having had physics. This should not be. In an age when almost every act one does is tied in with some phase of physics, why do not more students choose this course which will be of such benefit to them?

My story must go back about twenty years when I first began to teach physics. When I entered my stock room at that time I found a few large pieces of equipment suitable for class demonstration of some of the more technical work, and very few of the simpler things that could be put into the hands of the student. Immediately an effort was made to build up our equipment so that we had eight complete sets of apparatus for the simpler experiments that students normally can do. In our laboratory there are eight tables where four students can work together, making possible a class of thirty-two. The collecting of this apparatus was not all done in one year but extended over a period of several years.

With this set-up it is possible for all students to perform the same experiment at the same time. This makes possible one explanation of the exercise to the class at one time. It keeps the course a unit, as the exercises can be done at exactly the time when the material is being taught in the classroom. It encourages individual work as there is no group that has had the experiment before to whom they can go for help. The instructor has more time for individual instruction because less individual instruction is needed.

No laboratory manual ever fits exactly the needs of the teacher in his particular course. A large amount of time is wasted explaining substitutions of apparatus or differences in procedure that must be used. For these reasons my co-worker, Mr. Palmer, and I set out to write our own. Again it was not all done in one year, but over a period of years, rewriting, revising, adding or eliminating as seemed necessary. But the result was a manual which exactly fitted our equipment and the things we wished to teach. These two things: simple laboratory equipment for everyone, and a manual to fit the equipment, have been large factors in holding the pupils in our courses.

It is probable that most of you who read this are working in systems where it is considered desirable that at least ninety per cent of the pupils who enroll for a course should receive credit for the course. Since our high school population has included more and more of those of the lower I.Q. levels, it has been necessary to do one of two things: lower our standards, or discourage many pupils from our classes who should have the training physics can give. Neither of these things is desirable.

Our solution to this problem came about eight years ago, when we started a second course called "Modified" Physics. The course is exactly what the name signifies; it differs largely in degree. First, insofar as possible the course is non-mathematical. As you know, it would be impossible to teach density without arithmetic, or water pressure without some calculations, but is it necessary to teach the average pupil the method of calculation of heat of fusion or vaporization, the calculations in connection with lenses and mirrors, or the formulas involving series and parallel connection of cells? Second, the course is non-theoretical. We teach the kinetic theory of matter, but we omit a technical explanation of osmotic pressure or surface tension.

Laboratory work is a must. We have one double period each week. We feel that it would be impossible to hold our pupils if they had no part in the laboratory work. Again, the laboratory work differs in degree from that of the regular course. Some experiments such as moments of force, parallelogram of forces, and acceleration due to gravity are omitted; others are revised. For this course we have prepared a special manual which has simplified instructions that are

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Escuela Agricola Panamericana

The Pan-American School of Agriculture

• **By Marion Mann**
DIRECTOR, MIDDLE AMERICAN INFORMATION BUREAU, NEW YORK, N. Y.

This is an account of a significant experiment in education in Latin America where both land and people are undeveloped. The effect of this "good neighbor" project will be far-reaching.

Natives learn best when trained on their home ground, by teachers who understand them, in an atmosphere of typical native problems.

Here you may visit them at school.

To teach the youth of Middle America the most modern scientific methods is the purpose of the newest type of agricultural school in that area. The training of students in these many recently opened schools, with the subsequent employment of scientific methods on the production of crops, will diversify the agriculture and improve the standards of living of the forty-six million people of Middle America, four-fifths of whom live on or by the land.

One of the best known of these schools is the Escuela Agricola Panamericana, maintained by the United Fruit Company in Honduras, and situated in a delightful valley near the capital, Tegucigalpa. So eager were the first students to start their studies that the School opened in the summer of 1943, with construction only two-thirds completed. The grounds cover 3,500 acres—more than five square miles—and include forested mountainsides a mile high, along with hundreds of acres in fertile valley fields. The average altitude is about 2,600 feet; high enough to grow many northern cereals, vegetables, and deciduous fruits, but warm enough for most important crops of the true tropics.

The School's Director is Dr. Wilson Popenoe, internationally renowned authority on tropical agriculture. He is known affectionately to all who study or teach there as "Doctor Pop." He has carefully geared the curriculum to the practical agrarian leadership of the American tropics, and brings the full force of modern technology to bear directly on the problems of tropical agriculture. Under his leadership, Escuela Agricola Panamericana has been called "a great pioneering dream come true" and declared to be "potentially invaluable to the future of tropical America."

Perhaps the story of the School and its teaching methods can best be told in the words of the noted writer, Louis Adamic, who attended the first Commencement Exercises earlier this year. Following are excerpts from his recent article for *Woman's Day* magazine.*

"Sixty-three young men graduated. They had come from seven countries. Between 19 and 23 years old, they are typical Middle American farm boys. The majority are sons of poor families in primitive, tradition-bound mountain villages and jungle settlements. They had little previous education. But now, after taking the regular three-year course, they are expected to become effective agents of Agricultural Progress in Middle America.

"A striking fact about the School is that none of its graduates will be employed by the United Fruit Company, which so far has put over a million dollars into it for plant, maintenance and operation. The company is building up a three million dollar endowment fund. The School engages in vocational training, not to provide technical personnel for United Fruit, whose main business is bananas, but to spread moderately advanced agricultural methods among the general run of farming people in the American Tropics—outside the banana industry.

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THE GARDEN AT THE SCHOOL of Pan-American Agriculture in Honduras, with students obtaining practical experience in scientific gardening methods. A mango grove is in the center; the tower of the main building, Zemurray Hall, is at the left, among coyol palms.

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Recommendations Relating to Free and Low Cost Materials for Science Teaching

• By Harold E. Wise, Ph.D. *(University of Michigan)*
ASSOCIATE PROFESSOR AND SUPERVISOR OF SCIENCES, TEACHERS COLLEGE, UNIVERSITY OF NEBRASKA, LINCOLN, NEBRASKA

Most science teachers are eager to use the supplemental teaching aids furnished free by manufacturers, provided the materials are without objectionable advertising, are in convenient form, and can contribute effectively to the educational program. Unfortunately, all the material offered is not acceptable. Some valuable aids are not used to their full advantage by teachers.

Recently, two great national educational associations have studied the question so that they might tell the producer how to prepare his materials and the teacher how to use them.

Here is an account of the progress made.

In the autumn of 1945, a thirty-two page report entitled, "The Place of Science in the Education of the Consumer," was released cooperatively by the Consumer Education Study of the National Association of Secondary School Principals and the National Science Teachers Association.[1] This report[2], prepared by a committee of the National Science Teachers Association under the chairmanship of Mr. Nathan A. Neal, Board of Education, Cleveland, Ohio, set forth the relation of science education to the total consumer education program and suggested certain areas of consumer education in which science instruction could make a major contribution.

As a direct outgrowth of recommendations made in the Neal report, a second consumer education study in the field of science was completed during the academic year 1945 to 1946. This study, like the first, was prepared for the Consumer Education Study by a committee of the National Science Teachers Association. The study had as its objectives: (1) to improve the quality of supplemental teaching aids made available to schools by merchants and manufacturers by providing physical specifications and content suggestions considered to be desirable; (2) to stimulate the use of acceptable commercial materials in science teaching; and (3) to provide standards by means of which commercial materials may be evaluated by teachers. The scope of the report was restricted to material relating to booklets, charts, exhibits, models, and pictures.

[1]An abstract of this report was published in the September, 1946, issue of *The Science Counselor.*

[2]Copies of the original report may be obtained from The Consumer Education Study, 1201 Sixteenth Street, N. W., Washington 6, D. C.

The completed report, a booklet of 61 pages bearing the title, "Specifications for Commercial Supplementary Teaching Materials for Science,"[2] has recently been distributed to business concerns affiliated with the United States Better Business Bureau, while an abstract of the report, with content suggestions omitted, has been distributed to members of the National Science Teachers Association.

As prepared by the committee, the report contains five major sections dealing, respectively, with: (1) the use of commercial supplementary materials in the teaching of science; (2) the quantity and type of advertising which seems to be acceptable in materials used in schools; (3) suggested physical specifications for commercial supplementary teaching materials for science; (4) content suggestions for specific booklets, charts, exhibits, models and pictures considered to be appropriate for instruction in science; and (5) suggestions for the implementation of the report.

The points of view of the committee as reflected in each of these sections together with some indication of the nature of the content are briefly summarized in the paragraphs which follow.

The Place of Commercial Supplementary Materials in Science Instruction

Certain kinds of commercial materials, of the types included in this report, may be invaluable to the science teacher as sources of information not presented in the text or reference books available. Rapid advancements in pure and applied science during recent years have caused a phenomenal increase in the scope of material which might be legitimately included in high school science texts. However, in the interest of clarity of presentation of the fundamental principles of any area of science, the textbook author must exercise careful judgment in the selection of illustrative applications and development material. Space does not permit him to include an adequate discussion of all of the specific applications of any one principle, nor can he include a discussion of all principles or topics which might be of interest to his readers. Again, it is well known that science textbooks cannot be kept strictly up to date regarding current developments which are frequently of great interest to science students. Properly prepared commercial materials can do much to supply to teachers and science students desirable supplements to text materials as well as new information as it becomes available.

Commercial materials are also useful as a means of developing interest in science both within the school and in the community. One effective means for stimulating such interest is through the use of science exhibits in the school museum, library or hall exhibit case, or in some instances, in appropriate exhibit places outside of school. While exhibits of this type frequently are intended to attract school patrons and pupils who are not enrolled in science, similar displays or collections of posters and charts closely related to a unit of study may be profitably used to maintain a stimulating atmosphere in the classroom.

A third and very important use of commercial materials is in connection with the development of the special interests of individual students. Such special interests include many varied science topics and applications. An extensive library of supplemental materials drawn from commercial sources can contribute to meeting this need.

Advertising Restrictions Desirable in Commercial Supplementary Materials

There is growing conviction both by education and by business that in communities where the level of education is high, the standard of living and, therefore, the demands for goods and services provided by business are also high. The manufacturer, distributor, institute, or trade association which adopts a long-range point of view in the preparation of materials for distribution to the schools and seeks through these materials to help raise the level of general education by giving accurate, unbiased information regarding products discussed is contributing ultimately to better business conditions.

School administrative officers, as well as classroom teachers and the general public, are agreed that schools should not be used to promote the financial interests of any individual or group of individuals. Commercial materials which seek directly to promote immediate financial gains are very little used in schools. The materials, therefore, fail to bring an adequate return on the investment, even though they may possess considerable educational value.

The advertising restrictions which are endorsed by the committee are those proposed in an earlier bulletin of the Consumer Education Study, *Commercial Supplementary Teaching Materials*. They are as follows:

1. Contribution to the Educational Program.—To be usable in classrooms, commercial supplementary teaching materials must contribute positively and effectively to promoting without distortion the educational program approved by the responsible educational authorities of the school.

2. Absence of Sales Promotion.—Commercial supplementary teaching materials must not contain direct promotion of sales. The name of the donating firm should appear, but not with such emphasis or repetition as to subordinate the educational content, and it is also permissible for the donor to list unobtrusively his important products or services. But there should be no boastful claims for them, no efforts to persuade, no urges to buy or to try.[1]

The authors of the bulletin in which these criteria are first presented state that the criteria represent principles which have been generally agreed upon by competent representatives of both business and education. They have been adopted by the committee of the National Science Teachers Association in the hope that they may serve as guiding principles for business concerns as educational materials are prepared and for science teachers in the evaluation and selection of supplemental teaching materials.

Physical Specifications for Supplementary Teaching Materials

The use of commercial supplementary teaching materials, while recognized as a valuable aid to instruction by many teachers, is apparently not as extensive as the potential instructional value of these materials seems to justify. One reason for this limited use is undoubtedly due to the fact that many of the available materials possess physical features which make them difficult to catalog, store, exhibit, and use.

The committee recognized in this situation an opportunity to make a contribution which would be mutually helpful to teachers and to distributors of commercial teaching materials. As a result, considerable time and effort were spent in preparing suggested physical specifications designed to encourage practices of construction which would insure greater uniformity, durability and usefulness in each of the types of materials considered in the report. While space does not permit the reproduction of these specifications in the present summary, interested persons can easily secure a copy of the original report from the Consumer Education Study.

Content Suggestions for Typical Areas of Science Instruction

This section of the report was prepared primarily for the guidance of commercial concerns. It presents suggestions for specific booklets, charts, exhibits, models, and pictures considered to be appropriate for use in instruction in the general areas of elementary science, health education, biological sciences, and physical sciences.

These suggestions of specific aids were secured by six sub-committees working under the direction of the central committee who carefully examined the content of science curricula and secured suggestions from many teachers of science in representative sections of the nation. These suggestions were formulated to meet the

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[1]Consumer Education Study, *Commercial Supplementary Teaching Materials*, 1201 Sixteenth St., N. W., Washington 6, D. C. Page 20.

Bikini Paid Off

• **By Paul G. Sullivan, M.A., LL.B.** *(Duquesne University)*
LIEUTENANT COMMANDER, U.S.N.R., PITTSBURGH, PA.

This is an eyewitness account of Bikini—at least all that can be told at present. It is written to counteract some of the dangerous complacency to which the writer refers, complacency that should alarm every thinking American.

Mr. Sullivan, a successful Pittsburgh lawyer, had had a varied career in sports as player, coach, radio announcer, and journalist, before joining the Navy.

If a third test is made at Bikini, Mr. Sullivan hopes to be there.

It is generally bad practice to begin an article with a disavowal of capacity, but I'm afraid I must violate this tenet and declare that, in writing of the atom bomb tests at Bikini last summer, I am unqualified to treat from the scientific standpoint either the subject of atomic fission or the collateral topic of the technical phases of the experiment. Perhaps, however, some of my observations as a layman connected with the Photography Division of Joint Task Force One during Operation Crossroads may be of interest even to those whose understanding of the field, the perimeter of which I was fortunate enough to skirt, starts where mine leaves off.

If I have any excuse for invading the pages of a learned periodical at all, it is this: I discovered on my return from Bikini that many people have swung from their almost preternatural horror of the A-bomb as described after the war-time drops on Hiroshima and Nagasaki to a dangerous complacency toward it in the light of reports following its first use against naval armament. In other words, disappointing radio broadcasts and a rather poor press from the site of the Crossroads detonations have resulted in a pretty widely spread attitude that the atomic weapon is something of a dud and atomic warfare is far from the menace it was cracked up to be in August of 1945. These paragraphs are an effort to modify upward the presently prevalent impression.

There was so much extravagant talk, even by responsible scientists, of the destructive potentialities of the bomb that nothing short of a cosmic upheaval in Bikini Lagoon could have satisfied or even stirred the imagination of a public that had been fed on predictions of tidal waves sweeping to the shores of California and holes blown into the ocean floor to let the seas escape into the center of the earth. Since nothing like that sort of thing happened and, indeed, well under a dozen of several scores of vessels in the target fleet failed to ride out both the aerial and the shallow water blasts, a feeling of letdown ensued from reports of the entire elaborate affair.

The difficulty is that there is a disposition to consider with illogical disillusionment what the bomb didn't do, instead of regarding with awed appreciation what it did. Now I haven't seen how the first detonation affected the desert area in New Mexico where it took place, and I have inspected neither of the ruined Japanese cities where atomic devastation amassed a toll of lives in the scores of thousands from the threefold terror: explosion, fire, and radioactivity. But I was privileged to watch both Test Able—the air drop—and Test Baker—the shallow water burst—at Bikini and, within hampering limits of space and my own ability, I shall try to tell what happened there.

As Vice Admiral W. H. P. Blandy, commanding officer, repeatedly stated, Operation Crossroads was not undertaken to prove that the atom bomb would or would not sink warships or, for that matter, to prove anything whatever. Its purpose was to discover as nearly as possible what can be expected of the bomb if it is ever employed against shipping and at the same time what its effect might be if used on various items of armament and other materiel. That approach should rule out any verdict on whether or not the tests were "disappointing." If, from the tremendous wealth of physical,

REV. JOHN R. SCHULER, high school science teacher, Fellow in Physics, Graduate School, University of Cincinnati, civilian scientist with Radiological Safety Group aboard *U. S. S. Haven*. Here Father Schuler holds a Geiger-Muller counter.

chemical, and tactical data accumulated by civilian and military experts of the Task Force, there is derived information to steer this nation and, through it, the world into channels tending to save lives and property that might otherwise be sacrificed to the most withering force yet devised by man, the cost of Joint Task Force One in time, money, and obsolete and obsolescent ships will have been light. Personally I am confident that such information is being obtained.

Bikini Atoll is a more or less oval coral reef in a remote area of the remote Marshall Islands. It encloses a lagoon that is roughly 20 miles long and eight miles wide. Most of the reef is under water, but there are numerous points at which it emerges as islands so idyllically tropical that, as one of our cinema men remarked, a director might hesitate to copy them for a set lest he be accused of exaggeration. The three main outcroppings are Bikini, Enyu, and Amen and it was from six 60-foot towers on these, as well as from aircraft and ships of the service fleet, that the mammoth photographic record of the tests was compiled.

The main force of the Photography Division arrived at Bikini toward the end of May aboard *USS Saidor*, an escort carrier fitted up as the first major ship ever devoted entirely to picture-making. I followed by air from JTF-1 headquarters in Washington and landed in the lagoon on June 7. By the time I joined up, the installation of the radio-controlled cameras on the island towers and in the Navy Mariner seaplanes based at Ebeye back near Kwajalein was well under way, and the news, technical, and documentation photographers had begun their preliminary shooting.

Our group was known as Public Release Photography and it included, in addition to able Navy, Marine Corps, and Coast Guard units, the crack cameramen of the Civilian Newsreel and Still Pictures Pools. The job of these service and civilian specialists was to cover not only the detonations themselves, but also the ships of the target fleet "before and after taking," as well as the manifold activities and multitude of celebrities of the Task Force. I am not a photographer, but it was my duty to help assign the photographers, to see that they had facilities to complete their assignments, and to do as much as possible—frequently in the face of rather harrowing transportation difficulties—to make straight their paths.

In the course of our daily travels by small boat and the gunboat *USS PGM-29* we managed to gather a pretty fair slant on the set-up. We found that the target fleet consisted of the battleships *Nevada*, *Pennsylvania*, *New York*, and *Arkansas*, the former Japanese battleship *Nagato*, the carrier *Saratoga*, the light carrier *Independence*, the cruisers *Pensacola* and *Salt Lake City*, the former Japanese cruiser *Sakawa*, the former German cruiser *Prinz Eugen*, and a vast train of destroyers, submarines, transports, and special types. There was even a floating drydock, and a couple of burly Coronado flying boats were also included in the array, which, for Test Able, spread out like a wheel with the dazzlingly orange-painted *Nevada* at the hub and each class of ships constituting, roughly, a spoke. Distances from ship to ship were unannounced, but the plan was that recording instruments on each vessel would disclose the effect of the bomb at that point so that, after due comparison of data, a sound idea of what could be expected to befall a given sort of craft at a given distance from an A-bomb detonation could be determined.

Besides the primary concern over ships there was a strong secondary interest in other materiel: planes, guns, tractors, instruments, and numberless additional items on which it was important to procure data. Decks were cluttered with the strangest assortment of paraphernalia ever observed afloat, and every bit of it was checked meticulously prior to and after each test. What was learned is top secret, but we can feel assured that more is now known of what to look for from an atom bomb burst than was ever previously suspected.

Perhaps the most discussed subject of experiment was the shipload of animals trundled across the Pacific in *USS Burleson*. I was aboard the *Burleson* the day she dropped anchor in the lagoon and I had, shall we say, the pleasure of touring her hold. To be truthful, it was far better than I dared hope for when we set out. We descended a long ladder down a deep hatch and at the bottom were a fine lot of contented goats and pigs in clean and not at all offensive pens. They had come through the long trip handsomely and many of them were to survive the even more rigorous ordeal of Test Able. Several of the goats were literally college-bred. They came from Cornell University and, after close study of their nervous reactions under specially created conditions there, they were to be scrutinized from the same angles following Test Able. I could take the aroma of the goats and the porkers, but I asked to be excused very quickly after entering the compartment in which the thousand or more white rats were caged. Several weeks later, between tests, I returned to the *Burleson* to confer with Fritz Goro, the celebrated photographer of scientific subjects, and he escorted me through the rooms where animals killed in Test Able were being dissected. I didn't linger very long there either.

In order to obtain the most advantageous coverage of the tests and their immediate aftermaths, the Public Release Photography Unit was split up and distributed among various ships and planes. For both Able and Baker, I drew what I think was the choicest assignment of all: *USS PGM-29*. This trim, fast, little motor gunboat was one of six of its class allocated to the use of the Radiological Safety Group, whose function was to move into the lagoon after each blast and check air and water for radioactivity before re-admission of the rest of the service fleet. Members of the Group, including oceanographers as well as physicists, employed Geiger-Muller counters, bathythermographs, and other types of instruments to detect presence, amounts, and movements of radioactivity. Some worked directly from the PGMs, while others discharged their duties from tiny motor craft called LCV(P)s, which were delegated to the PGMs to increase the scope of activity by fanning out into satellite flotillas so that the circumference of the target fleet could be pretty well accounted for.

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Astronomy Can Be Fascinating

• **By Willard A. MacCalla, B.S. in I.E.** *(Lehigh University)*
PRESIDENT, AMATEUR ASTRONOMERS ASSOCIATION OF PITTSBURGH, PITTSBURGH, PA.

One doesn't have to study astronomy in school to build a telescope or to become an amateur astronomer—but it helps. Too few schools, however, teach astronomy, despite its cultural, recreational, and service aspects.

But America has many enthusiastic self-trained workers who find astronomy fascinating.

Read what one experienced amateur has to say.

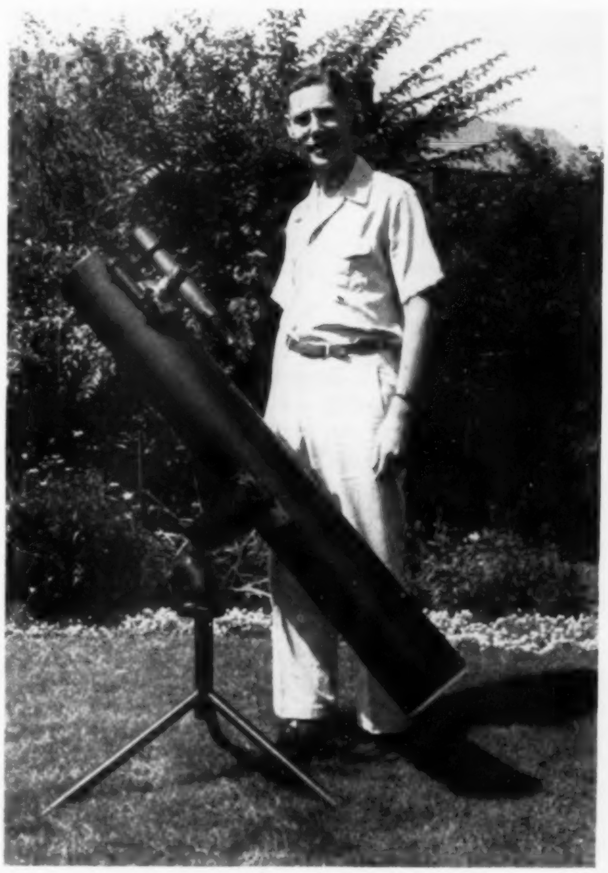
Picture any clear night, when the sky is sprinkled with stars, like diamonds on black velvet. On such a night you would not have to look far to find an amateur astronomer—one of several thousand in the United States—gazing intently into the eyepiece of his telescope, a precision optical instrument that is most likely the product of months of his own skill and perseverance.

Perhaps he is watching the changing positions of the moons of Jupiter, or marvelling at the beauty of the rings of Saturn. Maybe he is searching for a reported comet or a nova, a new star that has suddenly flashed into visibility from out of the inky blackness. Possibly his interest is in searching for the numerous galaxies within the range of his telescope—island universes so far away that their glow of light which he now sees has taken hundreds of thousands, yes, millions of years to reach him. On the other hand, if he is a more serious observer, he may be devoting his time to fundamental research in cooperation with professional astronomers, in such fields as variable star observing or comet seeking.

As the starry richness of the heavens sweeps across his field of view, this amateur astronomer is filled with wonder and admiration. He is touched with awe and reverence as he considers the terrific speeds, the mighty masses and the vast distances which he is contemplating. Unlike the professional astronomer, who is continually under pressure of time and responsibility to maintain schedules of prescribed research, and who, by the nature of his job must attack his work with a rigorous mathematical approach, the amateur, answering only to his personal urge to do or to know, is free to direct his attention to whatever field of astronomy he is most interested in. As he directs his telescope into the unbelievable depths of space, he can indulge in the luxury of pure sightseeing, leaving behind the Earth and its cares for adventure and discovery in the mysterious farther regions of the Universe. Not being bound by technicalities and the mathematics of astronomy, the amateur can speculate on the beginning and end, the why's and wherefore's of all he observes, and he can see himself and his own little world in the proper perspective. But what is most important, he gains an understanding of the power and glory of the Creator because of the expanse and the wonder of the objects he sees with his own eyes.

Of the many hundreds of amateur astronomers with whom the writer has talked, one amazing fact stands out—only a small handful studied astronomy in high school or college. Many schools do not even teach the subject. For instance, only two high schools in the Pittsburgh district, serving a population of nearly two million, have astronomy courses. Even where schools and colleges teach the subject, the impression is current that the course is extremely dry and full of the mathematics of parallaxes, reductions of elliptical orbits, the application of Kepler's Laws of Motion, etc.

It is most unfortunate that so many of us must wait until later on in life to learn that astronomy can be fascinating. However, entirely aside from the cultural



MR. MACCALLA and a six-inch reflecting telescope of his own manufacture.

and recreational aspects of this subject, astronomy in this modern age is truly a fundamental science. Researches in modern physics, chemistry and electricity are based upon the atom, and so is astronomy. Indeed, many of the facts of atomic behavior were first discovered and studied in the stars. Because of the fundamental bearing on the fields of optics, meteorology, biology and communication, a conversance with modern theories of astronomy will lead to a proper understanding of present-day science. It is for this reason that the science teacher is interested in encouraging the dissemination of astronomical knowledge. Perhaps a look-see into the activities of a typically active amateur astronomical society will give the teacher a clue as to how he can stimulate a greater interest in the subject, either in connection with an established course in astronomy, or as an adjunct to an existing science class.

The Amateur Astronomers Association of Pittsburgh, one of a few dozen such organized groups in the United States, maintains its headquarters in the Buhl Planetarium and Institute of Popular Science. The membership of about two hundred includes people in all walks of life, including a railroad president, a street car operator, a butcher, a baker, engineers and salesmen, high school boys and girls, grandfathers and mothers and some professional astronomers as well. There are some who are interested in this organization for its cultural value, and are content to come to the regular monthly program meetings where prominent astronomers and scientists address the group. For the most part, however, the interests of our members lie principally in shop activities and observing.

In the shops of the Buhl Planetarium, the amateurs have been provided with a fully equipped machine shop, grinding and polishing rooms for mirror and lens making, and an optical testing tunnel. Under the supervision of competent amateurs, members of the Association have the free use of the facilities of this shop. During the past year thirty-three parabolic mirrors ranging from 4" to 10" in diameter, and several complete telescopes were finished. The quality of work is demonstrated by the fact that typical mirrors are ground and polished, then figured for parabolism to a tolerance of one millionth of an inch. To illustrate this accuracy, if a 6" mirror were magnified so that its diameter reached from Chicago to New York, no point on its surface would vary more than a foot above or below a perfect surface!

While practically all amateur telescopes are of the reflecting type, as are nearly all the huge modern professional telescopes, a great variety of mountings and optical arrangements are constructed. Members of the Pittsburgh group have built Newtonian, Springfield, Cassegranian and Schmidt types, with equatorial mountings and both manual and clock drives to follow the motions of the stars. There are even three complete observatories in the Pittsburgh district, built and operated by amateurs.

In the field of observing, the scope of activities is almost unlimited. For those without telescopes, there is the fascination of constellation study, observation and plotting of auroras and meteors, following the sometimes erratic motions of the brighter planets against the background of the so-called fixed stars, noting the times and directions of sunrises and sunsets, and the changing of the length of the sun's shadow throughout the year.

Greatly expanded opportunities are open to those who own or have access to a telescope. Our nearest celestial neighbor, the Moon, is the most interesting object for amateur observation. Throughout its changing phases hundreds of charted objects wait to be explored. Some of these are the great ringed plains, the numerous craters, the jagged mountain peaks ranging up to 30,000 feet in height, and the many curious clefts, rills, and rock faults. As the Moon moves through the sky, it frequently glides in front of some conspicuous star or planet. This is called an occultation. The abruptness of the disappearance of such a star when the dark side of the Moon is in the lead, is indeed startling. Even more interesting, however, is a lunar eclipse, when the Moon is cut off from the direct rays of the sun as it passes into the shadow of the Earth.

Many amateurs specialize in solar observing. The well-known periodicity of sunspots was discovered in 1838 by an amateur named Schwabe who made sunspot counting his life's hobby. Solar eclipses, rare for any one section of the country, are so spectacular that astronomers will travel thousands of miles to see the Baily's beads, the "diamond ring" effect, the glorious corona flashing into view upon the instant of totality, and the prominences—huge masses of incandescent gas thrown out hundreds of thousands of miles by eruptions inside the sun.

An executive of one of the large Planetariums, when recently asked whether he had ever seen a total eclipse of the sun, recalled that he was in a college physics class at the time of the 1925 eclipse. However, at his location the eclipse was only 99 per cent; hence, he observed only a partial eclipse through the classroom window, and missed the glorious corona phase. Had his physics professor arranged a trip of only a few miles for his students, they would have witnessed one of Nature's most spectacular laboratory demonstrations—a total eclipse of the Sun—an event which might well have stimulated a lifetime interest in science.

Exploring among the planets, the amateur astronomer is interested in observing the changing phases of the inner planets, Mercury and Venus, and notes with interest that Venus shines with greatest brilliance when but a slim crescent. Under good seeing conditions the polar caps and the markings, once thought to be "canals" on Mars, are glimpsed in small telescopes. Beyond Mars lies Jupiter with its prominent cloud belts and its polar diameter noticeably flattened due to its terrific rota-

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The Chemistry Course Needs Revision

• By J. C. Amon, M.A. *(University of Pittsburgh)*
DEPARTMENT OF CHEMISTRY, GEORGE WESTINGHOUSE HIGH SCHOOL, PITTSBURGH, PA.

Every paragraph of this article is based on the long experience and considered thought of one of Pittsburgh's best known and most successful teachers of high school chemistry.

Mr. Amon looks back over the years and considers how chemistry is taught in secondary schools. He is not wholly pleased. Improvement must be made if many likely young students are not to be discouraged from choosing chemistry as their life work. Educators and scientists should not continue merely to philosophize and to complain. They should act.

Quite a good many years ago, when I was young in the teaching game, I remember a conference with my high school principal in the course of which reference was made to the fact that pupils who had taken our chemistry course did so well when they went to college. That principal's reply, which did not register so well at the time, has come back to me many times through the years. It was, "Yes, but they die like flies by the way."

At that time my classes were small, 18 or 20 in number, and the pupils highly selected. It never occurred to me that what I was doing was just teaching the kind of chemistry I had learned in college and making but little attempt to reevaluate and simplify in terms of 16- and 17-year-old boys and girls.

Since then, I have thought a great deal about the sort of results we are getting; I have given much attention to the matter of simplification of materials and reassigning of standards of achievement; but I am afraid that I have been careless in the matter of reevaluation.

There still persists in my thinking the idea that our first objective is to train for college, and that accordingly we must be guided by the kind of material students are likely to need when entering college courses. This, too, I am afraid, has been the guiding principle in determining the content of our courses of study. A brief survey of the course of study set up for the Pittsburgh schools in 1931 would indicate this to be true. Taking the first semester as an example, the topics outlined are: Introductory, covering general topics such as physical and chemical change, units of measurement, etc., oxygen, hydrogen, water, solutions, laws, theories and hypotheses, chemical arithmetic, chlorine and hydrogen chloride, acids, bases, and salts, ionization, atmosphere, ammonia, nitric acid, and the oxides of nitrogen.

In my own teaching I find I must devote about one-third of the semester to laws, theories, hypotheses, and chemical arithmetic, and about one-fifth to salts, acids, bases and ionization. I never get to nitrogen and its compounds. I believe my experience is much like that of other teachers in the city. Of course, no one has ever said this course must be followed, and the implication is that we are free to follow our own best judgment. However, tests have been developed and approved, that if we are to use them pretty largely determine the material to be taught.

Furthermore, when the course of study was written, we had three single recitation periods and two double laboratory periods, each period approximately forty minutes in length. Now we have but five forty-minute periods per week. The outline for the unit on chemical arithmetic gives the following topics:

I. Definitions, atomic weight, molecular weight, symbols, formulas.
II. Calculation of molecular weight from a given formula.
III. Calculation of percentage composition.
IV. Calculation of the molecular weight of a gas.
  a) Given its specific gravity.
  b) Given the weight of one liter.
V. Calculation of specific gravity and weight of one liter from the molecular weight.
VI. Calculation of the formula of a gas.
  a) Given percentage composition and specific gravity, or weight of one liter, or its molecular weight.
VII. Valence.
  a) Simple practical statement of meaning.
  b) Simple electronic interpretation.
  c) Importance and usefulness in writing formulas.
IX. Statement of the full meaning of an equation.
  a) Qualitative.
  b) Molecular.
  c) Quantitative.
X. Problems involving weight and volume.
XI. Kinds of chemical change.
  a) Oxidation and reduction: direct combination, decomposition, simple replacement, including electronic interpretation.
  b) Double replacement.
XII. Energy changes, treated qualitatively.

Suggested Laboratory Exercises

1. Weight of 22.4 liters of oxygen.
2. Equivalent weight of Magnesium.
3. Weight of sodium chloride produced by the action of hydrochloric acid on sodium bicarbonate.
4. Examples of kinds of chemical changes.

In my own classes, the pupils do quite well and show considerable interest until we come to this unit; then their interest wanes and achievement drops off rapidly. The majority of our failures develop with this unit, and the one on acids, bases, and salts. For the pupil who is going to college and plans to have a career in a technical field, perhaps this is as it should be. On the other hand, may it not be true that high school pupils are not mature enough to do the kind of thinking required for this type of work, or may not have the kind of preliminary training needed? In one of my present classes, I was not able to find a single student who would admit he knew how to find percentages. When so many new ideas are given them in so short a time they become confused, and none is learned well enough to be used intelligently.

For a number of years I have made a practice of having all the pupils who come into my classes for the first time, write out a statement telling me why they elected chemistry. Recently I examined 211 of these cards, and they show that of this 211, 104, slightly less than 50 per cent, were planning to go to college and felt they would need it; 39 were planning to be nurses, and 58 were taking it for a variety of reasons which I have listed as general interest.

Examining the records of 33 who have either failed, or are now failing, I find that 5 came from the group who wanted to go to college, 12 from the group who were going to be nurses, and 16, or nearly one-half, from the general interest group. Thus it would appear that we are doing fairly well by the college group, but probably are over the heads of a goodly percentage of the balance of the group which makes up more than one half the total. While I have not made an analysis of the grades of this general group, I am confident I would not find many of them among the higher grade groups. I am quite sure this experience is not unique in our school.

More than twenty years ago, in a diagnostic study of the subject matter of high school chemistry, Dr. S. R. Powers made the following observations:

> "Some units were not learned with sufficient thoroughness to be retained even for a short time. The teacher was convinced that the fault was not all with the pupils, for there was good reason to believe that they had made reasonable effort. . . . Clearly, neither the labors of the instructor nor the labors of the students were finding justification in knowledge outcomes, for the students were failing to gain any adequate comprehension of much of the subject matter which had been made the basis of instruction. These observations . . . led the investigator to hypothesize that the task set for accomplishment by high school students is too large and that the materials of instruction are but poorly mastered by those who study it."

In spite of the fact that this study was made long ago and that the experience of nearly every teacher of chemistry is in accord with these findings, we have done very little about it. We are still offering the same type of material in too large doses to be even partially mastered; and this, too, regardless of the fact that our school population has undergone great changes in recent years. It would seem that somehow or other, a more critical evaluation of the subject matter of chemistry should be made and courses set up with specific objectives to be met.

By "specific objectives" I mean objectives for which some sort of a measuring scale can be devised so that the instructor can have some assurance that they have been attained. At present, we have neither specific objectives to be attained, except such as may be set up by the individual instructor, nor definite standards by which the achievement of the individual student may be judged. Surely, in a field where so much has been done, and which has played so important a role in providing "better things for better living", there must be a fundamental groundwork that can be well laid in our high schools. There must be more of the brilliant students who ought to find a place in the field of science, students who are not getting there because of the prematurely difficult barrier now being placed in their paths.

Is it not possible for the educator and the scientist to get together and use the skills both possess to discover what this fundamental groundwork is? Or must we go on forever with the educator philosophizing, and the scientist complaining, and science in general suffering, because we have failed to discover and stimulate the many fine students with a bent for science who ought now to be in the field. ●

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"Any educational program which makes a serious effort to assist the learner in understanding either himself or his world must give a large place to the sciences."

G. G. Ross
University of Kentucky
Twentieth Century Education

★

"Nevertheless, natural science is a necessary part of a liberal education, for the citizen must understand the natural environment in which he lives. Though scientific research can contribute little to the moral, intellectual, and spiritual revolution upon which the future of civilization depends, the scientific method and the scientific spirit have a considerable part to play in it."

ROBERT W. HUTCHINS
The Educational Record, July, 1946

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GLYCERINE—

PRODUCT OF A THOUSAND USES

• **By Georgia Leffingwell, Ph.D.**
RESEARCH STAFF, GLYCERINE PRODUCERS' ASSOCIATION, NEW YORK, N. Y.

Glycerine is a familiar chemical, but how much do you really know about it—its source, manufacture, different qualities, uses?

This is an interesting account, written by an expert, of a material of literally a thousand uses, a chemical not easy to purchase at the present time. Its scarcity is due to the world maldistribution of fats and to the fact that American housewives have not returned enough waste fats to their butchers.

Here are facts about glycerine you never knew before told to you by the author of a recently published authoritative treatise on glycerine.

The applications of glycerine touch almost every phase of American industry, so that today there is no other individual organic compound which enjoys so wide a diversity of usage.

It was a young Swedish chemist, Dr. Karl Wilhelm Scheele, who first discovered glycerine as far back as 1779. But for more than a century afterward it was regarded as little more than a scientific oddity because of its strangely varied properties.

Glycerine is derived primarily from the glycerides which are present in, and essential to, all life and growth, vegetable, animal, fish, fowl, and human. Another source is through fermentation of sugars and grains, which accounts for its natural presence in wines, beers, ales, bread, and other fermented products.

This fluid is recovered commercially from fats by saponification processes, the variations of which may be described briefly as follows: (1) by combining the fat with an alkali, thereby releasing the glycerine. (2) By low pressure hydrolysis by water with the aid of a catalyst. (3) By high pressure hydrolysis in a digester with or without a catalyst. Process No. 1, which is commercially the most important, produces soap and glycerine. Processes Nos. 2 and 3 produce fatty acids and glycerine. The crude glycerine yield from Process No. 1 is known as "80% soap lye crude," while that from Processes Nos. 2 and 3 is similarly known as "88% saponification crude."

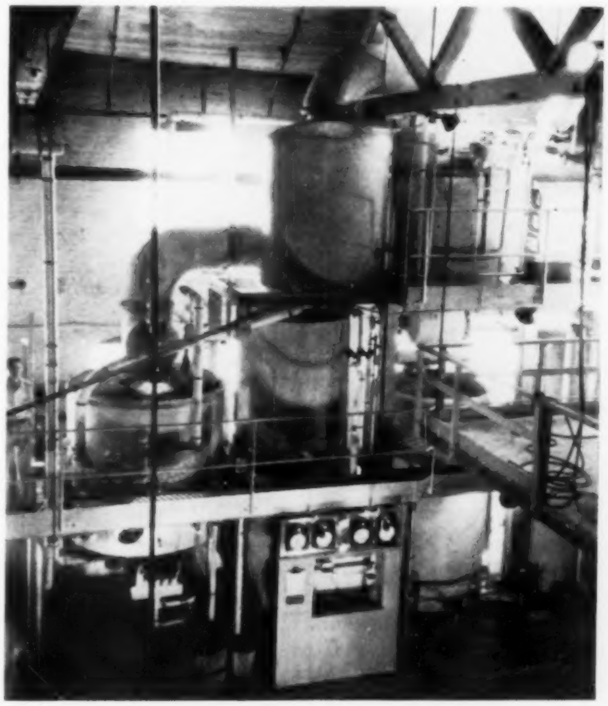
The purification of both types of crude (saponification and soap-lye) involves distillation of glycerine at low pressures and treatment with decolorizing carbon.

Refined glycerine is sold in four principal grades: (1) **Chemically Pure** or U.S.P.,—a high grade, water-white glycerine meeting the requirements of the United States Pharmacopoeia. It is suitable for use in foods, pharmaceuticals, cosmetics, or for any purpose where the highest quality is demanded. It has a specific gravity of 1.249—25°C./25°C.; (2) **High Gravity**—A pale yellow glycerine for industrial purposes, with a specific gravity of 1.262—15.5°C./15.5°C.; (3) **Dynamite**—A yellow glycerine made especially for the explosives trade, which has a specific gravity of 1.262—15.5°C./15.5°C.; (4) **Yellow Distilled**—A yellow glycerine for industrial purposes with a specific gravity of 1.259—15.5°C./15.5°C.

Obviously since the fats used in soapmaking are the principal and most economical source of glycerine production, the present glycerine shortage is an aftermath of, and is primarily due to, the world maldistribution of fats during the war years.

The situation is summarized by N. N. Dalton, Director of Research of the Glycerine Producers' Association, as follows:

> "The Japanese occupation of large oil producing areas in the Far East required diversion to our Allies of large quantities of our domestically produced fats without normal compensating imports of coconut oil, palm oil, and other soap fats. Also,



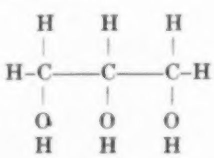
GLYCERINE REFINING EQUIPMENT.

military necessities required the exportation of 88 million pounds of glycerine from the United States to its allies in the years 1940 to 1944 inclusive. With both fats and glycerine, it was a case of a great deal going out and very little coming in.

"During 1945, although our glycerine imports balanced exports, the heavy demand for rocket powder in addition to other war uses, depleted our domestic stocks to an irreducible minimum. Up to date in 1946, glycerine exports have been practically nil and substantial imports have been helpful in supplementing our low rate of glycerine production resulting from scarcity of domestic fats.

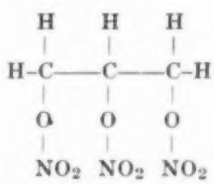
"In a free market with good fat supplies, the glycerine situation righted itself almost immediately after the end of World War I, but with the longer duration of World War II and its consequent greater maldistribution of fats and longer drain on world glycerine supplies, the return of glycerine to its normal world surplus status is naturally being retarded. The 1946 estimated United States available glycerine supply including import balance is estimated at 190 million pounds, which is 50 per cent more than the average 1935-1939 yearly domestic disappearance, but the present low inventories of both producers and consumers, combined with heavy immediate reconversion demands, indicate that glycerine may be in short supply until well into 1947."

Pure glycerine is a colorless, odorless, sweet tasting, viscous, high-boiling, substantially non-volatile liquid. Its molecular structure is:



It is a trihydric alcohol, and as such, its use in explosives and resins depends on its ability to form esters.

Nitroglycerine is the ester of glycerine and nitric acid, and has the formula:



It is made by the action of nitric and sulfuric acids on dynamite-grade glycerine. Until the discovery by Nobel that nitroglycerine could be stabilized by absorption on kieselguhr, it was of no practical value on account of its instability. The mixture of nitroglycerine and kieselguhr became known as dynamite. Later Nobel also found that nitroglycerine could be stabilized by admixture with nitrocellulose. This product is known as blasting gelatine.

Another commercially important type of glycerine ester is that obtained by the reaction of glycerine with polybasic organic acids. The most important of these polymerized esters are alkyd resins, which are products of the reaction between glycerine and phthalic anhydride. These resins, modified with various fatty acids or oils, are the bases of a large percentage of the baking enamels and quick drying varnishes and enamels. They are also used in the manufacture of printing inks and coatings for moisture-proofing paper.

Other large scale uses into which glycerine enters as a chemical raw material are in the production of ester gum from rosin and glycerine, emulsifiers from fats or oil and glycerine, solvents, such as triacetin from acetic acid and glycerine, and a number of pharmaceuticals such as glycerophosphates and glyceroborate.

In addition to the uses depending upon the ester-forming properties of glycerine as a trihydric alcohol, glycerine is a parent compound for the production of ethers, aldehydes, and such unsaturated compounds as acrolein. As an alcohol, glycerine also has the ability to form salts such as sodium and potassium glyceroxide which are easily prepared and serve as raw materials for the preparation of glycerine derivatives. Lead glyceroxide is widely used as a cement.

The use of glycerine in tobacco processing is one of its major industrial applications. Glycerine, today, is almost universally regarded as indispensable in the manufacture of cigarettes because of its unique properties of absorbing and retaining moisture and preventing dryness, coupled with the fact of its scientifically proven wholesomeness for this usage. The casing mixture offers the principal applications of glycerine to utilize these advantages, many modern casing mixtures consisting only of glycerine and water.

That the advantages of glycerine may be utilized in foods with entire safety is proved by a series of tests made at the department of physiology of the University of Chicago.

With these varied characteristics, it is not surprising that there is hardly a branch of manufacture in which glycerine is not used, either as a constituent of the product itself or as an ingredient of some specialty designed to facilitate processing or improve the finished product. ●

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"The teacher is successful at the moment when his student becomes original."

Mark Van Doren
Liberal Education

★ ★ ★ ★ ★

Cinematography—A Liberal Art

• By Anatole G. Lindsay
DIRECTOR, CATHOLIC DEPARTMENT OF VISUAL EDUCATION, FILMS INCORPORATED, NEW YORK

This paper deals with motion pictures as a liberal art, and points out the responsibility of teachers to train students to react rationally to the pictures they see, whether they are entertainment or instructional films.

The writer's out-of-the-ordinary point of view will be of interest to teachers of science who are likely to look upon films only as teaching tools or pure entertainment.

In this paper I shall limit myself to the role and place of one of the liberal arts in the Catholic educational system, namely the art of Cinematography.

Motion pictures, as yet, have not been widely recognized by our schools as an art, and they have not taken a place in the curriculum similar to that now occupied by literature, music, and other liberal arts. Many other countries have already included cinematography in their school curricula.

Since long ago, particularly in French schools, the study of the Theatre has been on a parity with the teaching of literature. Russia has a special University of Cinematography. Germany and Italy had one like that under Mussolini and Hitler. The League of Nations had an International Institute of Educational Cinematography. These countries realized the tremendous propaganda power and the spiritual as well as the intellectual influence of motion pictures upon people. Since it is true that the totalitarian countries have seen the power of the motion picture for their propaganda purposes, how much more we in a Democracy should give intelligent thought to the subject of the use of motion pictures for educational purposes and character building. Very often the same instruments can be used for good as well as for evil, for life as well as death.

In our country, unfortunately, there are still many people who deny cinematography a place among the arts. This in spite of the fact that to produce motion pictures all liberal arts are called to cooperate and participate and to fuse and give birth to this new form or art. Their objection is that the motion picture cannot be an art because it is produced by mechanical means, such as the camera and celluloid. If this were a valid reason, then we would not have any liberal arts at all. Indeed, in order to paint we need a brush and colors; in order to write we need a pen or typewriter and paper; in order to compose music we need paper and pen; in order to play music we need instruments, and so on. The material means used to embody the spiritual and intellectual thoughts varies according to the different arts.

Another reason sometimes advanced to deny cinematography its place among liberal arts, is that as yet no product probably is worthy of that name. Here again the reason is not valid. Motion pictures are only the product of cinematography and not cinematography itself. The fact that the product is not artful is not proof that this art does not exist. Even if all the books ever written were bad, there would still be, abstractly speaking, such a thing as literature, and all that would be needed to make it apparent would be just one good book. At least one good film, everyone will agree, has already been produced.

Even if in spite of these facts, there still are Catholic educators who would not agree that cinematography is a liberal art, nevertheless I hope they will agree that motion pictures have a place in the Catholic school curriculum. As a matter of fact, with a few exceptions, most diocesan superintendents of schools favor and advocate the use of motion pictures. The resistance, if any, does not come from the reluctance and unwillingness on the part of teachers to give motion pictures a place in the school curriculum, but from the plain fact that 16mm. sound equipment is still too high in cost, and some schools do not have the necessary funds to acquire it.

There is little doubt today that motion pictures are a powerful medium for the propagation of ideas. Indeed, not only the instructional films, but even and perhaps more so, entertainment films in some way or other express a definite philosophy and are built upon certain values. The entertainment films can be Christian or non-Christian in their phases; can be in agreement or disagreement with the Divine moral laws and with the established social, historical or economical order.

Too often, unfortunately, people think only of instructional films when talking of the field of education. While the former, as their name indicates, are more pertinent to the field of scientific knowledge, the latter are of the utmost influence as far as our spiritual, moral and social life is concerned.

In many countries the potentiality of motion pictures as a medium of influencing and directing the trend of thought of the people in one direction or another, have been fully realized.

Of course, we do not want to limit and discipline our children and our people into a regimented train of

thought; however, we have to remember that any theatrical film expresses, condones, or condemns some phase or philosophy of life, and that in almost any one of them there are moral values and moral issues involved.

This creates a serious problem of educational responsibilities on the part of our schools and educators. The time has come when a special motion picture program and a special course in appreciation of motion pictures should be introduced into our educational system. Such a course can and probably should include the study of the history and development of motion pictures; in other words, it should be a course somewhat similar to our present one in literature.

It is a matter of common knowledge that many things are shown on the screen which are in direct contradiction with the teachings of Christianity. Insofar as the frequent viewing of such things on the screen may constitute a danger to one's Faith, we may call this danger ideological. However, another matter to consider is the tendency of many European countries to produce movies that have "social significance." In Russia, every movie must directly or indirectly further the Soviet program. In Germany, films were extensively used to further Nazi ideology. In France and England, more movies with social significance are being produced. So far, movie producers in this country have been fearful of taking this step, although several such films have already been produced and others imported. It is a reasonable assumption that in the future an attempt will be made to produce such pictures in this country. If this happens we can be sure they will lean toward Communism rather than away from it.

Now all this leads to the conclusion that the time has come when motion pictures should be recognized by our schools as an Art, and should be treated as such; when our teachers should assume the responsibility of training our children—the adults of tomorrow—to react not only emotionally, but also rationally toward the pictures they see. Above all, we must train these "parents of tomorrow" to detect fallacious theories or principles, and to recognize the good ones involved in the pictures they see, by projecting and testing such theories and principles against the background of Catholic teaching and ideals. ●

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"The college period is too short a time in which to get enough education to carry one through life. Hence a primary purpose should be to help everyone to *learn how to learn* and equally to want *to keep on learning* on their own account. Adult education, formal and informal, is an essential part of any plan to assure more and better scholars."

ORDWAY TEAD
Chairman, Board of Higher Education, New York City
Bulletin, Association of American Colleges, May, 1946

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Escuela Panamericana

(Continued from Page 104)

"The idea behind the school is hooked to the personal sincerity of Samuel Zemurray, who thought about it fourteen years before he became managing director of the United Fruit Company in 1932. Mr. Zemurray saw that the undeveloped resources of most tropical countries in the Western Hemisphere lay mainly in their people and their land. The problem was to improve the relations between the two. There was no provision for training dirt farmers to engage, on farms of any size, in intensive work with field crops and livestock, so that the population's stamina could be raised through a better diet. What seemed essential to real agricultural and therefore human advance in countries like Guatemala, Salvador, Honduras and Nicaragua was sound vocational training acquired on home ground in the atmosphere of native problems.

"Mr. Zemurray came across a man named Wilson Popenoe, a Kansan brought up in California, and an outstanding tropical horticulturist. Tall and thin, wired to a dynamo of nervous energy, a maniac for work, and a disciplined fanatic on tropical plant life, Dr. Popenoe had explored Latin America for the Office of Plant Introduction in the United States Department of Agriculture, and become the leading authority on the avocado. He wrote the standard book on tropical fruits. He was put in charge of the idea.

"Honduras persisted as Mr. Zemurray's first choice. He felt strongly on one point: the spot ought to be as close to the center of Middle America as possible, and typical of the altitude and soil conditions from which most of the students would come and to which, he hoped, they would return. He was partial to boys in low circumstances, mainly because he felt they might have more initiative to work hard and make something of themselves than sons of prosperous families. But whether a boy was poor or rich, the training offered him by the school would be entirely free. There was to be no favoritism or discrimination in any shape or form because of the boys' racial and family backgrounds. Intelligence and eagerness to learn were the qualities that counted.

"The School was formally dedicated on Columbus Day, 1944—the main building as Zemurray Hall, in memory of Major Sam Zemurray, Jr., who died in action on an Army plane in North Africa early in 1943.

"From the start, classroom courses have been limited almost entirely to subjects directly related to agriculture. Because of the dearth of textbooks on tropical agriculture in Spanish, the boys start learning English as soon as they reach the campus. In the first year they study arithmetic and biology.

"More than half the EAP program consists of work outside the classroom. Farmer-like, students and faculty are up at five-thirty. By six-thirty they are at

work in the dairy, the vegetable garden, the fruit groves or the slaughterhouse; with the annual crops, the pigs, the poultry, the oxcarts or the mechanical equipment; at the sugar mill or the tannery. They put in four hours every morning, rotating the jobs so that each boy covers the whole scope of manual activity.

"Indoor classes meet for three hours in the afternoon most of them closely related to the morning's work outside. This system has been remarkably successful. All students put their hands to all manner of tasks. There are no servants in the dormitories and the mess hall. Director Popenoe, nicknamed "Doctor Rapido," and staff members wear work clothes throughout the day and are frequently seen pitching in on this or that job and hustling bundles and sacks across the campus as a matter of course. A thorough-going personal democracy prevails that takes in everybody, and by-and-by everybody likes it and is part of it.

"Not counting the first outlay for the plant, the average cost per student per year is about $1,000. There are no fees of any kind. The scholarships are all-inclusive, covering quarters, food, clothing and medical and dental attention; in many cases, where boys come from some distance and are unable to stand the expense, transportation is also included.

"In 1946, the student body numbered 160, which seems to be the ideal number for the School's system of education. Much of the instruction is intimate and personal, and specially effective for that reason. The students, under some direction but more and more by themselves, do nearly all the work, raising about 90 percent of the food consumed in the community, including all the meat, milk, butter, cheese, eggs and sugar. The School does not sell anything.

"During vacations, not over half the students go away at the same time. For one thing, most of them don't want to or can't afford the trip; for another, it takes considerable manpower to work the place. Those who do go home for a few weeks are encouraged to take along a great variety of seeds and plants and cuttings, settings of eggs from the EAP's pure-bred chickens, or even a couple of full-blooded Hampshire pigs, for farms in their villages. As a result, several hundred tropical-American farms already are noticeably better than they were two or three years ago. Even cattle are distributed among the specially reliable graduates.

"The emphases at EAP are on the individual boy, on giving him every encouragement to get all there is to be had at the School; on common sense; on gradual progress, on progress which starts from the present level of tropical agriculture. There are motor trucks and tractors on the place, and they are used; but much of the hauling is done in oxcarts and a good deal of plowing by ox-drawn plows. If the student is going to work on his parent's farm, the chances are that he cannot afford motor equipment right away. But the oxen and carts and plows and harrows used at EAP are somewhat better than those on the average tropical-American farm, and the student is taught indirectly, as a matter of course—how to keep his oxen and his more or less primitive equipment in the best possible condition.

"The Escuela Agricola Panamericana is Pan-Americanism on the level of the *peoples* of the Western Hemisphere. It is Good Neighborliness at its most effective—not only between the United States and the Latin-American lands, but among the latter. The graduates hailing from various countries plan to keep in touch with one another, to meet every so often. In an informal talk the day before graduation, Dr. Popenoe urged them to write to him or to any other member of the staff any time, or to come back for consultation, or to send for seeds, eggs, or whatever they need that the School is able to furnish.

"At the beginning, some of the people in Middle America viewed the School with skepticism. Now everybody, whether Right or Left or middle-of-the-road in politics, approves of it 100 per cent. On hearing someone refer to it as 'an excellent project,' a Latin-American educator, who attended the first graduation, said: 'This is not a project. It's an achievement.' "

Mr. Adamic's report of what he saw for himself during his two months' stay does much to show the scope and breadth and vision of the EAP, but the true value of the School's curriculum gleams brightly in the aspirations expressed by some of the graduates. One student hopes to establish cooperatives for the small farmers in his country. Another hopes to teach the Indians to read and write. Still another intends to teach his Middle American countrymen to eat more vegetables to improve their health. Several have been invited to El Salvador, where the government, under the combined leadership of the Institute for Social Improvement and the Ministry of Culture, is establishing model farms in each Department of the country. Many of the graduates will teach others, as one said—"By showing them how to pick the best milk-producing cows, encouraging good production, showing them sanitary milking conditions and the best use for the milk. All this I will do through simple explanations as well as through practical demonstration."

Thus, the graduates of the Escuela Agricola Panamericana, whose instruction is so basically practical, will one day help their native lands to achieve a truly lasting level of well-being and prosperity. ●

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"Science is now universally recognized as our major resource—both for wealth and security—and as such is inevitably a public concern. If science is to be fruitful, it must be both strong and free. Domination either by military or bureaucratic arms of government would inevitably lead only to sterility.

WILLIAM E. WICKENDEN,
President, Case School of Applied Science
The Educational Record, July, 1946

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Bikini Paid Off

(Continued from Page 108)

PGM-29, ably captained by 24-year-old Lieut. (j.g.) Norm Thomas of Buffalo, was stationed outside the atoll about 13 miles from the center of the target for Test Able. This test had been postponed by President Truman from May 15 to July 1 and because of the delay and the consequent shift in the tropical seasons the weather prognosis was very bad. That was the first of a series of miscalculations, for July 1 proved to be the brightest, calmest, most beautiful day imaginable—even better than the lovely, trade-wind-cooled days that preceded and followed it. As a matter of fact, I don't believe that in the two months I spent in the Bikini area there were more than two or three really unpleasant days. We had occasional brief showers and some overcast, but even these were quite exceptional. Both test days were perfect.

The second miscalculation was in the brilliance of the flash accompanying the detonation. I don't doubt that the brightness in the close neighborhood of the blast was terrific, but in the dazzling sunshine and with 13 to 25 miles separating the flame-burst from observers our precautions of wearing glasses smoked almost to opacity, turning our backs, and closing our eyes and shielding them with our arms proved nearer to absurdity than necessity. Most of us thus missed the start of the show, which was bad enough inasmuch as it might have been avoided if any one had known better. What was worse was that the news photographers, fearing for their long-awaited pictures, inserted filters so heavy that no light whatever penetrated to the film. As Art Gaskill, "News of the Day" cameraman with whom I worked on the *PGM-29*, wrote on his dope sheet describing the rolls he sent back to the Naval Photo Science Laboratory, "You can use this stuff over again; it hasn't been exposed yet!" Fortunately the remotely controlled cameras on the towers and in planes and the many cameras in the hands of service photographers on shipboard were less thickly filtered, so splendid coverage in all media was obtained. Of course, Gaskill and his confreres promptly removed their filters and made magnificent records of the plume of the explosion and, subsequently, of the havoc. It's too bad they had to miss the flash itself, but there was no opportunity for second guessing and neither Task Force authorities nor the cameramen themselves can be blamed for using their best judgment based on the most reputable information available.

Anyway on that eventful morning of Test Able we all stood forward on the gunboat, headed toward the spot of the drop. We counted off the scheduled 47 seconds between, "Bomb's away!" and the burst, blacked ourselves out a dozen seconds before the limit, and held the blindfold a few after till some intrepid—or inquisitive—character shouted, "O.K.! There she is!" Then we opened up and saw curling from the horizon off the starboard bow a great, white, flame-shot plume that rose and rose, billowed and twisted, up and up beyond the lazy, little summer clouds that were swallowed and lost as the mighty symbol of the A-bomb soared to its lofty limit of 40,000 feet.

That was at 0900, on the nose. More than a minute after the burst, we heard a faint boom. By 0910 we were heading for the lagoon entrance. The plume was spreading in the upper air current and by 0920 it had dissembled so that it looked like all the rest of the white, tufty clouds, though much higher.

At 0925 we knew the *Saratoga* still floated and a few minutes later we beheld the gay, orange key objective, the *Nevada*, "sitting there," as one lad said, "like a house on a hill." Other familiar silhouettes were rising from the smoky mist. It was evident, to the mingled joy and slightly disappointed surprise of the Task Force, that there was no harrowing derangement of the target array. Still, destruction had been wrought, for black smoke and occasional spurts of fire were discernible at widely separated points and, though we joked and as Navy men felt a bit proud that our ships still rode the surface, we were quickly convinced that the units within fair range of the blast had taken a severe kicking around.

We entered the lagoon at 1215 and caught our first damage shot—the gallant light carrier *Independence*, veteran of many a bitter battle, blazing aft beneath a buckled flight deck, her island flattened and her stern a shell. We edged on toward a great, brilliant green patch of water where, it seemed, a whole cargo of dye marker must have been spilled. We saw many thrilling, amazing sights which, for reasons of space and military security, I shall not describe in detail. But there were fires, an explosion or two, and everywhere, on ships within a broad area around the detonation, superstructural damage that ranged from trivia to shambles. The destroyer *Lamson* was turned hull over and the transports *Carlisle* and *Gilliam* were gone. The Jap *Sakawa* was down at the stern and, as a matter of fact, sank the next morning, hardly half-an-hour after we had cruised around her on a picture-taking run. When we bedded down late on the night of Able Day not a cable length from the dark, silent *Saratoga* with the *Independence* still ablaze, we had seen naval and a lot of other history made.

Test Baker found me back on *PGM-29* on another perfect morning, this time with Chief Photo Mate Bill Gustafson, USN, a former Pittsburgher, shooting stills and Chief Photo Mate Harold Whitwer, USCG, succeeding Gaskill on the movie assignment. This time there was no fussing around with smoked glasses, though we were only eight miles from the mooring place of the barge on which the bomb would be set off by way of an elaborate system of electronic controls, devised with the most intricate safeguards against premature detonation. We just stood there and watched as we waited for the dramatic radio word. All hands were ready with cameras this time when it came. With startling suddenness, on the very heels of the call, the sea rose from its surface, bulged, straightened into a broad, flame flecked column that whitened as it pushed majestically skyward, then burgeoned into the vast semblance of a magnificent, snowy tree.

A minute, maybe two or three, it seemed to hang suspended. Then disintegration began and the whole mighty mass—trunk nearly a half-mile in diameter and foliage perhaps two miles across—settled back into the billowing surface to form high, sweeping waves that appeared to engulf the lofty ships lying in their way. White combers broke across the distant beach. The only sound we caught was a single loud, thumping report like a good, rousing beat on a giant bass drum. We were too far off to hear the fall of water or the hiss of steam, though doubtless there was plenty of both.

While all this happened, we were driving toward the mouth of the lagoon. All eyes scanned the target fleet with eager anxiety, for this time, we felt sure, there'd be an eloquent void in the center. But there wasn't. One by one, the major ships emerged from the clearing mist: the *Saratoga*, the *Nevada*, the *Pennsylvania*, the *New York*, the Jap *Nagato*, the battered hulk of the *Independence*. The cruisers loomed and the destroyers and transports, apparently all of them. But no one glimpsed the rugged, old *Arkansas*. She had disappeared in the seething fury of the blast and was seen no more.

After lurking outside the lagoon as the unmanned, radio-controlled drone boats ran in for preliminary radiological safety tests of the water, we slid through the reef just before 1100. By now it was obvious that the *Saratoga* was settling badly. She maintained an even keel, but before 1300 her flight deck was as low as the deck of a battleship. As we wormed through the fleet, into and out of the super-"hot" water, we perceived that the sub-surface detonation in Test Baker, in contrast to the effect of the air burst in Test Able, had wrought its chief destruction to hulls rather than to superstructures. There were, to be sure, numerous evidences of the air and water rush that followed the upthrust of the explosion. Deck installations and miscellaneous gear were battered about. But this was minor.

As the day wore on, it was obvious that the real damage was under water. At 1610, with lumps in many a Navy throat, we stood a scant quarter-mile off and watched the gallant *Sara* rise gently and slide under. She passed quietly, easily, like a grand, old lady dying in her bed. I didn't look around for a moment till I'd blinked the mist away. Some one said, "The Japs would have given a lot to have seen that a while ago!" And that was certainly the truth.

I could set forth a myriad more details of interest at least to us who were there. But I shall try to hold to the limits of my thesis and relate merely that the next day we noticed the destroyer *Hughes* and a sizable transport being towed to the beach to avert sinking. Meanwhile the rusty, rugged, punch-drunk Nipponese *Nagato*, listing sharply to starboard, edged lower, ever lower till one morning a few days later we looked and she just wasn't there at all. Several smaller craft, including of course the bomb barge, were also dispatched in the holocaust and what structural and internal damage was done to the surviving ships is not a matter for this informal and unclassified record.

Because I am not qualified to delve into the mysterious and terrible attributes of radioactivity, I have not attempted to treat extensively of this vital factor in the results of the A-bomb, nor shall I try to do so now. I shall state, however, we were almost without exception acutely and apprehensively aware of the presence of this deadly force. We had no sensory perception of it, but the Geiger-Muller counters told us it was there, often in dangerous concentration, even long after the blast. Most of us on the *PGM-29* were exposed to considerably more than the low tolerance fixed by the medical authorities. We had to evacuate the ship the night of Baker Day and bunk on a transport that hadn't taken the dose we had soaked up in our meanderings through the target fleet. I hate to think what would have happened to any man on those target ships exposed to the primary radiation. Fortunately none of us who encountered it second-hand showed ill effect.

Well, that's about my story. I'll conclude by repeating: don't judge the atom bomb by the fantastic things it didn't do at Bikini; consider the unprecedented things that it did. Remember that no other man-made instrument ever sank even one major ship with a single, unaided blow—and don't forget, if you forget everything else of Operation Crossroads, that the A-bomb in Test Baker finished off the *Arkansas*, the *Saratoga*, and the *Nagato*. Think of what a cluster of those bombs could do to a large, crowded harbor—like New York or San Francisco. Then pitch in with your share toward accomplishment of effective control of this weapon that has posed the historic alternatives: one world or none! ●

The Chemist in Court

(Continued from Page 100)

White Coffee Beans

Mr. M. became violently ill and died shortly after eating breakfast. Symptoms and autopsy indicated arsenic. The widow claimed that there could not have been arsenic in the food since they had both eaten of the same foods.

While taking samples of the foods I noticed that her cup and saucer had not been used, although she claimed to have had two cups of coffee. When I called her attention to the clean cup and saucer, she said they had been washed since breakfast. She also volunteered the information that her husband always made his own coffee, using freshly ground beans. He used an old-fashioned grinder fastened to the window sill.

When I started to examine the grinder she became greatly excited. What I found was white coffee beans. The beans were mixed with a white powder, which proved to be arsenic trioxide. As the coffee was ground the white would disappear, and the ground coffee had a nearly normal color. The widow was convicted.

Growing Poisonous Vegetables

In a complicated legal controversy it was thought necessary to know if vegetables grown in soil containing poisonous metallic compounds might absorb enough poison to be dangerous to health. Some previous experimenters had failed to find absorption; others had found that traces had been absorbed.

I was asked to repeat a carefully controlled experiment in which several vegetables were to be planted in soil to which a known amount of a soluble lead compound had been added. I prepared such a soil by removing the top soil of a garden patch, weighed it and spread it on a concrete platform. After adding a weighed amount of lead nitrate so that there would be 10 parts per million of lead present, the earth was replaced on the garden patch, and peas, beans, carrots and tomatoes planted in it. In an adjoining patch, containing no lead, the same vegetables were planted.

The plants in the poisoned soil did not grow as well and as large as the controls, and the vegetables were fewer and smaller. At the close of the season, analysis showed that the controls contained no lead, but all the others contained detectable but very small amounts. The quantitative analytical method used permitted the estimation of parts per million, and had to be conducted during the summer when students were not at work in the same building, and there was no lead dust or fumes in the laboratory. The amount of lead found was too small to be objectionable.

Forensic Miscellany

Arsenical poisoning may be caused by arsine generated by certain molds such as *Penicillium brevicaule*, growing on wallpaper containing arsenical colors. Such wallpapers are now prohibited in most states. Cleaning fluids containing poisonous or flammable compounds frequently find their way into court, especially when their composition is not plainly stated on the label.

In spite of compensation laws, and regulations for construction and inspection of factories, a great variety of dusts find their way into the forensic chemist's laboratory. The worst dust in industry is sand, free silica (SiO_2). The smaller its particle-size the more dangerous it is. The determination of silica in mixtures containing silicates, and the measurements for particle-size are somewhat complicated procedures. Dusts and dust-forming materials that I have analyzed include stone grinders, cement, gypsum, wall plaster, coal smoke, street dust, dust collected during cleaning feed bags, cinders, and others.

Frequently it becomes necessary to prove that effluents from coal mines, paper mills, canning factories, and other industrial wastes cause contaminations. Hair dyes, especially those containing silver compounds or paraphenylenediamine are frequently the basis for a lawsuit. The forensic chemist is expected to be able to identify blood stains. Drugs used for self-medication, a stupid and frequently dangerous practice, come into contact with the law every day. What was claimed to be the first antiknock gasoline dope came to my laboratory to be tested for the presence of lead. It was the basis of a lawsuit for some millions of dollars.

It was a difficult job to convince an enthusiastic inventor that carbon monoxide could not effectively be removed from the fumes of gas-burning stoves. His "invention" consisted of a device containing nickel wool which, he claimed, when hot would form a nickel-carbon monoxide compound. This in turn would decompose into nickel and carbon dioxide. It just did not work that way. Poisoned and adulterated foods and drinks are in court frequently. The city, state, and government food chemist must also qualify as a forensic chemist.

I once had to examine a lady's hat which the customer had returned to the dealer, refusing to pay for it because it was colored with an irritating dye and infected with lice. I found no offending dye, but the lice were there. Another woman brought suit against a soft-drink bottling company, claiming that she had found a mouse in one of their filled bottles. The company proved in court that a mouse could not get through the neck of the bottle, and that it could not have survived the alkali treatment during the washing of the bottles. An experiment showed that only a few small pieces of bones survived the alkali treatment.

Perhaps I have mentioned enough cases to indicate the requirements of a forensic chemist. He must be able to use a great variety of qualitative and quantitative analytical methods; he must know how to collect samples under unusual conditions; and above all, he must be able to arrange his findings so that when he is on the witness stand he can "tell the truth, the whole truth, and nothing but", without getting excited at the attorney who may attempt to confuse him. ●

Free Materials

(Continued from Page 106)

instructional needs in science; no attempt was made to judge the probability that commercial organizations might be interested in the production of specific materials.

The content suggestions have been organized under a list of conventional topics within each of the four areas of science instruction. It is not the intent of the committee that this list of topics should be considered a comprehensive curricular outline, or a suggested order of study, or a method of instruction.

Suggestions for the Implementation of the Report

It is hoped that the distribution of the report to business concerns and to science teachers may result in some measure of improvement both in the kind and quality of supplemental materials which are prepared for distribution and in the effective use of those materials in science teaching. However, it is recognized that the effectiveness of the report in stimulating improvement will be limited by each of two factors: first, the degree to which producers of materials of the types recommended may be willing or able to conform to suggested specifications; and second, the extent to which the materials, if produced, are secured by teachers and effectively used in science classrooms. It is hoped that the effect of each of these limitations may be progressively decreased through further cooperative efforts on the part of both business and education. ●

★ ★ ★ ★ ★

In Future Numbers

Among the articles planned for publication in future numbers are the following:

The Radio Workshops of the Radio Council, Chicago Public Schools,
George Jennings, Director

•

Factors Which Influence Longevity
Clive M. McCay, Professor of Nutrition,
Cornell University

•

Time for Science Teaching
Morris Meister, Principal,
Bronx High School of Science
President, National Science Teachers Association

•

How Science Teachers May Obtain Government Publications
Philip Johnson, Specialist for Science,
U. S. Office of Education, Washington, D. C.

•

A Summer Course in Field Biology for High School Students
Edith R. Force, Woodrow Wilson Junior High School, Tulsa, Oklahoma

•

Cave Men, 1947
Charles E. Mohr, Director,
Academy of Natural Sciences, Philadelphia, Pa.

Behold the Birds of the Air
Miss Edith Portman, Secretary,
Audubon Society of Western Pennsylvania
Mellon Institute, Pittsburgh, Pa.

•

The Smithsonian Institution Celebrates Its One-hundredth Anniversary
Webster Prentiss True, Editor
Smithsonian Institution, Washington, D. C.

•

Education in Science for Adolescent Youth
Rolland M. Stewart
Emeritus Professor of Education
Cornell University

•

Tyrothricin
G. H. Weiler, Jr.
The Sharpe & Dohme Co., Glenolden, Pa.

•

Synthetic Liquid Fuels Investigations of the Bureau of Mines
Arno C. Fieldner, Chief, Fuels and Explosives Branch, Bureau of Mines, U. S. Department of the Interior, Washington, D. C.

•

Aviation Education Source Book
Dr. Leona Sundquist, State College,
Bellingham, Washington

•

Victor Francis Hess
Sister M. Laetitia, O. P.
St. Agnes Academic School,
College Point, L. I., N. Y.

NEW BOOKS

Laboratory Instructions in Biochemistry

• By ISRAEL S. KLEINER and LOUIS B. DOTTI, 2nd Ed., 1946, The C. V. Mosby Comp., 245 pp. $2.50.

This manual is designed especially for students of medicine and dentistry. The work is planned to enable the student to learn basic biochemistry and also to apply this knowledge to physiologic, pathologic and clinical problems. The authors have done a good job. In addition to the usual exercises found in most biochemistry laboratory manuals, there are experiments on cerebrospinal fluid, poisons, metabolism and tissue. The manual is bound in a modern loose-leaf plastic binding. The pages may be easily removed and re-inserted.

Charles H. Becker

General Biology

• *By* WILLIAM C. BEAVER, Ph.D., 3rd.Edition. St. Louis, Mo.: C. V. Mosby Co. 1946. Pp. 659. $4.75.

This book, written by a professor of biology at Wittenberg College, gives a comprehensive survey of all fields of biology. It is divided into four parts: Introductory Biology, Animal Biology, Plant Biology, and General and Applied Biology. The Appendix contains a good glossary of biological terms and a useful list of prefixes and suffixes used in biology. There are 321 text illustrations and 14 color plates.

Introductory Biology covers general biological facts, including the characteristics of protoplasm and the cell, cell division, and types of cells and tissues found in animals and in plants. Animal Biology begins with a survey of the classification of the animal kingdom. This is followed by a discussion of the different activities of animals and the structures necessary to carry them out. Each topic is discussed in relation to each of nineteen animals, representing the different groups from amoeba to man.

Plant Biology covers the plant kingdom in a similar way, beginning with a survey of classification, then discussing the activities of plants and the structures concerned with each activity.

General and Applied Biology covers broad biological principles, including unity and interdependence, ecology, geographic distribution, paleontology, genetics, variation, and evolution. A brief discussion of the chemistry and physics of living things follows. A chapter on applied biology is a restating and summary of what has been given before in regard to the economic importance of plants and animals.

This book has two principal defects. Because of the immense amount of material covered adequate discussion of most topics is impossible; many things are simply mentioned. The other defect is that the outline form introduces a good deal of repetition. This is particularly true in plants, where the chapter on seed plants is composed mostly of material scattered through the preceding chapters. Also, the chapters on respiration, correlation, and food relations necessarily include saying the same thing many times, since these processes are essentially similar in a large number of groups.

The principal advantage of the book is that any biological topic will be found with at least a slight discussion. The table of contents alone requires eight pages. The average student in General Biology might be confused by such a great mass of detail; he might find it a better reference book than textbook.

T.D.H.

Twentieth Century Education

• *Edited by* P. F. VALENTINE. New York: Philosophical Library. 1946. Pp. 655 + IX. $7.50.

This "comprehensive symposium" ably overviews the major phases of our American program of education. The contributors, distinguished educators and scholars, summarily present the educational philosophies permeating all levels of the American school. In a necessarily succinct manner, these eminent specialists offer to a critical and, therefore, interested American public. a concise explanation of the theories and practices underlying our education.

The introduction by the editor of this symposium briefs the reader on the present condition of American education. Dr. F. P. Valentine presents in a genuinely impartial manner what has been accomplished, and recognizes the many needs which have not been supplied. After this introduction, the authors endeavor to give the "meat of idealism, of the realistic view, of personalism, of the pragmatic theory, and of the Catholic philosophy.

In equally lucid exposition, the basic divisions of educational psychology receive creditable treatment. Clinging to the foundation of their educational tenets, the contributors state their conceptions of problems, appealing not only to the teacher and administrator but also to those outside the professedly educational sphere.

The ever-recurring discussion concerning the scientific method in education receives further consideration in this volume. American educators have adopted the scientific attitude, but one wonders whether other fundamental attitudes have been sacrificed to the serious detriment of an educated people.

The school undeniably has its social functions. Unless these are developed and encouraged, our system would be wanting in one of its chief objectives. After the sociological foundation of education has been dem-

(Book Reviews Continued on Page 125)

Fascinating Astronomy

(Continued from Page 110)

tional speed. The positions of its four brightest moons vary from hour to hour, and these moons often can be seen to cast their shadows on the face of the planet. Probably the most beautiful planetary object is Saturn with its magnificent system of rings. From year to year the rings are seen at varying angles, and at different times appear to us inclined upward or downward, and once every fifteen years they are viewed edge on.

Uranus and Neptune, seen as faint greenish discs, thrill the observer when he considers that they were unknown to the ancients, who were unequipped with telescopes. The outermost planet, Pluto, was discovered in 1930 by an amateur astronomer, Clyde Tombaugh, while doing student work at Lowell Observatory. This planet is so small and distant that it is beyond the range of small telescopes. Searching for comets, those strange members of our solar system, is a specialty of many amateurs, outstanding among whom is Leslie Peltier, Delphos, Ohio, who has over a half dozen comets and novae to his credit. By means of a telescope, the observer is able to resolve certain stars into double or multiple components. These "double stars", as they are called, are, for the most part, binary systems rotating about a common center of gravity. Another field of stellar interest is in observing the many spectacular colored stars. Because of its light-gathering power, the telescope brings out vividly the many hues such as red, orange, topaz, and garnet, indicators of surface temperature and evolutionary stage. Still other observers chart the changing magnitude of long period variable-stars, using charts containing constant brightness comparison stars. Such work has been turned over almost exclusively to the amateur astronomers under the direction of the American Association of Variable Star Observers.

Rather hard to find, and requiring a knowledge of star groups are the globular and open star clusters, diffuse and planetary nebula, and the distant spiral nebulae. Perhaps the most famous of these and best known to the layman, are the Hercules cluster of over 100,000 stars; the huge patch of violently agitated gas known as the Orion Nebula; the beautiful ring nebula in Lyra, looking like a colossal cigar smoke ring; and the great spiral nebula in Andromeda, that pin-wheel shaped galaxy of stars nearly a million light years away.

In the field of public service the amateur astronomer, because of his desire to share the fascination of his science-avocation, is generous with his time and ability. For instance, a qualified group of Pittsburgh amateurs, operating on a regular schedule, voluntarily serve at the 10" Buhl Planetarium public telescope on every clear night, where they lecture on the various celestial objects as they come into view. Sky shows and astronomical exhibitions are staged on appropriate occasions. Such an exhibit was assembled by the Pittsburgh amateurs at Allegheny College a few years ago when the faculty requested assistance in popularizing a newly established course in astronomy. In addition, many illustrated lectures and observing nights are conducted for the benefit of churches and Boy Scout groups, as well as high school and college science classes. In one Pittsburgh high school, a telescope-making project was initiated under the manual training department, with the counsel of the Pittsburgh amateurs.

Here, indeed, in astronomy, is a field so fundamental in its scientific impact, so stimulating to the imagination, so uplifting to the soul, and with all this, so utterly fascinating, that it is to be hoped that all our boys and girls may be furnished with the opportunity through scout and other youth activities, as well as schools and colleges, to gain an interesting introduction to this subject. In so doing we will be helping to build mind and character, and at the same time will be giving to those many young folks who continue to follow the study of the stars as an avocation, a life-long legacy of pleasure and contentment. ●

Book Reviews

(Continued from Page 123)

onstrated, insistence that the end of our system should be a "fuller realization of democracy," especially in postwar education, forces one to acknowledge the serious purpose of our scholarly educators. All levels from childhood education to higher education evidence a more democratic spirit than was prevalent years ago. It is true that fully developed programs do not exist at this time, but a serious effort toward making education more effective for the individual and society gains momentum day by day.

A thoughtful perusal of this overview of American education will be profitable to educator and layman alike. For the educator, it is more than a re-acquaintance; for the public it is a precise statement of how far we Americans have progressed toward a desired program of education.

Rev. George A. Harcar, C.S.Sp.
Dean, School of Education
Duquesne University

English-French and French-English Technical Dictionary

• *By* FRANCIS CUSSET. Brooklyn, N. Y.: Chemical Publishing Co. 1946. Pp. 590. $5.00.

The publisher states that this dictionary covers the various technical fields "with great competence and accuracy," and the technical fields specifically named are those of "Metallurgy, Mining, Electricity, Chemistry, Mechanics, and Sciences."

The reviewer has examined the dictionary from the viewpoint of a chemist and finds that the dictionary falls short of its claims in the field of chemistry. No French equivalents were found for the following terms chosen at random: amide, dextrin, enzyme, ester, cellulose, nitrite, olefine, rayon, water glass, wetting agent, xanthate. Similarly, no English equivalents were found for the terms: l'e'tate naissant, la cinétique, chaine latérale.

The background of the author, who is a mining engineer, explains the abundance of words translated only in the terminology of metallurgical and mining engineering. For example, one finds the word "noyau" translated to mean "core" in the sense of casting, but there is no mention of the possible meaning "nucleus" (as in "benzene nucleus").

A number of words listed in the dictionary appear to the reviewer to be anglicized French expressions, such as alcometer, aquiferous and araemeter, and there are many useless repetitious entries like "alcohol" and "alcohol (synthetic)," "ammonia" and "ammonia (synthetic)," "rubber" and "rubber (synthetic)."

In spite of the above shortcomings and various misprints, it is felt that the dictionary has a place on the book shelf of a technical library. However, a chemist will find it necessary to call to his aid still another dictionary, one which pays greater attention to his specific field.

Harry H. Szmant

Concentrated Arc Lamp

(Continued from Page 102)

audio frequencies. Thus the lamps can be used in telephoto systems, for facsimile telegraphy and for light-beam telephones or telegraphs. Because the lamps have so small a source, such a light beam can be very narrow. For example, a two-watt lamp can be used with a lens to project a beam which, at a distance of one mile, will be less than one foot in diameter. In clear weather it will give good voice communication for distances up to several miles. Such a beam can be directed so as to reach only the person for whom it is intended, which makes this type of communication system more secret and less liable to interception than any other.

The new lamps have been used for many other purposes. The examples which have been mentioned, were chosen to show their wide range of application. Their characteristics and properties are so different from those of any other type of lamp now available, and the results which can be obtained with them are so unique, that it is hoped that Concentrated-Arc Lamps will help in the solution of many more of the problems of science and industry. ●

A Physics Course

(Continued from Page 103)

associated closely with the data table and with the questions at the end of the exercise. Each experiment ties in with what is being studied in the book at that time, and not what we had two weeks ago or will have a week later. The laboratory and class work must link within the week, or laboratory work is largely wasted.

Every physics teacher uses visual aids. But in addition to the models and demonstrations which are common in the physics classes we use a large amount of projected material, slides, filmstrip, and motion pictures. There are many free films available from various industries that are worth while, as well as teaching films that may be rented. We are fortunate in having a library of teaching films in our school. This makes them available at the exact time they are needed. This is most desirable, for if the film, like the laboratory work, can not be used within the week, it may be time wasted.

No two of us could agree exactly on what should be taught and what should be omitted in such a course. But after all, no two courses are alike anyway. Is it not possible for us to forget some of the things which we have always thought necessary in our courses, perhaps necessary to satisfy college requirements, and arrange a course in physics which will be at the level of the average high school student?

Can we not teach a little less physics to a great many more people, and in so doing make life more pleasant and understandable for them? ●

The Editor's Mail

"I marvel at your ability to collect such an outstanding list of contributions as you do in each issue. It is very, very well done, and Duquesne University deserves a great deal of credit."

President of an eastern University

•

"It is good to know that *The Science Counselor* is once more available for our science classes. In the past the articles have been stimulating and a source of information and encouragement. I do want you to know that I have appreciated all that your magazine has done."

A Nun teaching in a high school

•

"Our Chapter of the Catholic Round Table of Science has had many members inquiring at each meeting when *The Counselor* would reappear, as the Chapter is unanimous in declaring that it is the most helpful aid our science teachers receive."

From the far West

•

"Seldom have I seen a more successful attempt to present scientific affairs so interestingly, so simply, and yet so effectively. I hope you will believe me when I say that I think you are doing a first class job for science. We are all indebted to you and your co-workers."

The Dean of a Virginia College

"Present day teachers of the sciences, it seems to me, put too much emphasis on the theoretical side. We need more interpreters. Your *Science Counselor* is a move in the direction of interpretation. It puts flesh on the dry bones of research reports."

Noted university professor of chemistry

•

"I enjoyed reading the September, 1946, issue that just came to my desk. The articles, as they were in the years gone by, are interesting and attractive. I think you are publishing an exceptionally fine magazine. I wish you every success in its continuation."

Managing Editor of a national Education magazine

•

"Ever since I was sponsor of a Junior Academy of Science Club some ten years ago, I have been interested in *The Science Counselor*. At that time one of my students was president of the Junior Academy of Science, and you carried a paper he wrote."

Director of Education of an
Academy of Natural Sciences

•

"I am happy to receive the first issue published since the necessary interim. As usual, I expect to keep a file of *The Science Counselor* available for the use of my students and myself. It is a pleasure to send the subscription price."

Head, Department of Chemistry of a famous
Southern College for Teachers

Improvement of Teaching

(Continued from Page 98)

Readers of *The Science Counselor* require no supporting argument to any plea for better salaries for teachers. And they would also be the first to admit that there is room for improvement in the training of science teachers. A part of the trouble with teacher preparation lies in the fact that public school teaching is not generally recognized as a profession at all. To practice law or medicine, one must study three or more years beyond the Bachelor's degree and pass a searching examination. But to have the responsibility of making good citizens of our children, some of whom even their parents are unable to control, very little if anything beyond a four-year college course is considered necessary. This must be changed if teaching is to become a real profession. The latest committee report recommends as a beginning that the college training for teachers should cover five years instead of four and that state or federal aid should be provided to facilitate this added training, somewhat as is now done under the Smith-Hughes Act. It also recommends the inauguration of proficiency examinations which, unlike the Medical or Bar examinations, would be voluntary, at least at the beginning.

But there must be a change in the character as well as an increase in the length of the training period. At present the typical college graduate is prepared far too narrowly by his college for the variety of subjects that he must teach. In spite of considerable lip service to breadth of education, colleges have prescribed progressively narrower and more specialized major sequences, which provide good competence in one science field, sometimes two, but almost never in three, which is the minimum number of subjects which a beginning science teacher is likely to encounter. The program for the liberal arts degree should be "liberalized" to allow prospective teachers to acquire this breadth of preparation.

The preparation of teachers in the subject matter they are to teach should definitely be at the hands of the respective departments in the colleges, whether such instruct'on is "professionalized" or not. To do this effectively will require a change of attitude toward Education departments on the part of many college teachers. Many excellent teachers of science at the college and university level are not qualified, unaided, to train prospective high school teachers in the art of teaching. The Committee seems quite unanimous in the feeling that one of the major handicaps to effective functioning by science departments in the preparation of teachers is the typically negativistic attitude of science departments toward departments of Education. Whether justified or not, this attitude is in itself impeding the discharge of one of the major responsibilities of the colleges, namely the preparation of science teachers in their respective fields.

Any measure that reduces or clears up the aversion of subject-matter teachers for Education (for in many cases it is no less) will facilitate the effective preparation of teachers of science. There is reason to suppose that if individual teachers of sciences in colleges would the department of Education, they would receive competent and informed help to a degree that would encourage further cooperative ventures.

But improved conditions, better training and adequate equipment are after all subordinate to the personality, the enthusiasm and the inspiration of the teacher. No formula of any kind can insure inspired teaching of science or any other subject. Only out of deep insight into the very soul of the subject being taught, coupled with the sympathetic understanding between student and teacher that characterizes human relations at their best, can really good teaching grow.

In the cultivation of a realization of the deeper significance of science and its place as a determining factor of the way men think in "the scientific era", we teachers are not as acutely aware of our opportunity as we should be. That opportunity was never more promising, and it is unlikely to come our way again in this generation, if ever. It is partly to a realization of this fact that the existence of the A.A.A.S. Cooperative Committee on Science Teaching is due. The only justification for its existence will be an ultimate improvement in the quality of science instruction in our public schools.—●

★ ★ ★ ★ ★

"The big paradox about science in America is that with all its vaunted use it is not given full sway; that while it is worshipped it is also feared; that while its strength is linked with the atmosphere of freedom in which it has developed, it has not released the social imagination nor fortified the social will; that the finest flowering of scientific genius in the realm of technology somehow manages to exist side by side with primitive and animistic taboos in the realm of social thought and action."

Max Lerner
American Scholar, Autumn, 1946

★

"To claim that the study of science is the best education for young men who aspire to become impartial analysts of human affairs is to put forward a very dubious educational hypothesis at best. Indeed, those who contend that the habits of thought and the point of view of the scientist can be transferred with advantage to other human activities have hard work documenting their proposition.

James Bryant Conant
Yale Review, Autumn, 1946

★ ★ ★ ★ ★

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1943-46

Articles are listed under author's name. Book reviews are listed under the name of the author of the book. (R) indicates a book review. The name of the reviewer follows in parentheses.